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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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A STUDY OF THE LIFE HISTORY AND FOOD HABITS OF MULE DEER IN CALIFORNIA*

By JOSEPH S. DIXON

With photographs by the author

(*Concluded from* CALIFORNIA FISH AND GAME, Volume 20, Number 3, July, 1934, pp. 181–282.)

* Contribution from the Wildlife Division, United States National Park Service

PART II—FOOD HABITS

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GENERAL STATEMENT OF FOOD HABITS

In general, mule deer in California browse relatively more than they graze, although at certain seasons fresh green grass may form as much as 90 per cent of the food eaten by California and southern mule deer. Browse is a general term applied to shoots, twigs, leaves and fruits of woody plants, vines, bushes and trees. Deer and domestic stock are said to graze on grasses, sedges and clovers.

In California, under normal conditions, mule deer forage in quite a different manner from domestic stock. Unlike domestic sheep or cattle, they scatter out when feeding and do not forage and trample the meadows in closely packed flocks or herds. There is also a decided difference in the degree of utilization of forage plants. Deer tend toward repeated but light utilization taking a nip here and there as they pass by food plants, whereas under similar conditions, cattle and sheep tend to stop and to browse heavily on such plants. The relatively light pruning by deer permits bushes and plants to keep up a continuous growth and is not so destructive to the range as is the heavy utilization and trampling of domestic stock. When mule deer breed and become overabundant, then serious damage to the range may result. Then even seedlings of coniferous trees may be killed by overbrowsing (see Fig. 116).

FIG. 116. Western yellow pine seedling killed by repeated browsings of mule deer. Yosemite, March 30, 1930. Wildlife Division No. 566.

METHODS USED IN THIS STUDY

In my study of mule deer in California, it soon became apparent that one of the critical factors which called for close observation and attention was that of their food habits and food preferences. Hunters, ranchers and stockmen, as well as naturalists, have given accounts of the food habits of deer at different localities and different seasons. Some observers have even gone so far as to state that deer never eat this or that plant, that grass is "seldom touched," and have made various other statements which need verification. In my study of the mule deer in California, I have purposely selected certain typical regions and have made detailed observations on the food preferences of deer in Modoc, Lassen, Plumas, Mariposa, Fresno and San Diego counties.

My study of deer has covered all seasons and extended over nearly a score of years and has involved a counted total of over 1000 deer that have actually been watched, for a total of approximately 680 hours, in order to see what their food preferences might be at different seasons of the year and under different conditions. In Yosemite Valley during a single period of observation extending from June 20 to July 2, 1927, a total number of 136 deer were watched for a total of 1218 minutes. By making such a comprehensive study, it is believed that a more accurate and a better general understanding of the food preferences of deer has been obtained than was previously known. It has been my experience that under certain conditions and in certain seasons of the year, mule deer will feed almost exclusively on certain types of foods and plants. If we took into consideration only such observations, a very biased picture would result.

In order to approach sufficiently close to deer to be able to see what they actually ate, it was necessary that the deer be fairly tame and not fearful of the presence of man. Another important point was that if the free, natural food preferences were to be studied it was necessary that the full complement of food plants be present, because it was soon recognized that deer on range lands or other areas that have been heavily grazed by domestic stock, of necessity ate whatever plants remained and were available at that time. For these and other reasons, it was found expedient to make a special study of the food preferences of deer in our National parks because there grazing by domestic stock has been practically eliminated and because there the full complement of native plants was present. Furthermore my study in Yosemite was made early before deer became overly abundant there.

Kentucky blue grass, meadow fescue and velvet grass are all present on the floor of Yosemite Valley. This not only gave the observer an opportunity to detect the food preferences of deer as regards native vegetation, but also gave opportunity to ascertain what the reaction of deer might be toward some of our most important introduced range plants and forage grasses.

In order to insure accuracy, I have verified my findings through the use of 8-power binoculars, which has made it possible for me to be able to see with certainty just what species of plant the deer were feeding on.

The duration of browsings has been recorded accurately "by the watch," and is not mere guess work.

Four methods of recording the findings regarding the food preferences of deer have been utilized. The first was to secure actual photographs of the deer in the act. In order to do this, it was necessary to use a fast, long focus lens, and to be within 25 feet of the deer. For this type of work, I found that a Ross telecentric lens of 17-inch equivalent focal length, with a value of F 5.4, fitted to a 4x5 Graflex camera, gave good results. By means of such apparatus, I have been able to secure graphic and dependable evidence showing what deer eat. In many instances I have not only been able to observe but actually to photograph deer eating certain plants or the foliage of certain trees

that I had been told were not eaten by them. The second means of recording such findings was my field notebook which I carried with me so that the findings could be recorded on the spot. In order to secure proper identification of certain species, it was found desirable to prepare regular herbarium specimens, which were dried in the usual manner, and later submitted to botanists. Field identifications have been based upon Sudworth's, *Forest Trees of the Pacific Slope* and Jepson's, *Manual of the Flowering Plants of California.* A fourth method of ascertaining and recording food habits of deer is by examination of stomach contents of animals that have died in winter or that have been killed during the open hunting season. This method furnishes a fair idea of the amount of food eaten at a meal and since mule deer usually browse twice a day, morning and evening, the daily food requirement of an individual can thus be obtained. For instance, the full stomach of an average sized fork-horn buck was found to weigh 12 pounds, which would represent a meal for that deer.

KINDS OF FOOD EATEN BY MULE DEER

Up to January 1, 1934, over 200 different kinds of vegetation have been found to have been eaten by the various races of mule deer in California. I have attempted to list these items of food under various groups, namely, (1) trees, (2) brush or shrubs, (3) herbs, (4) grasses and sedges, (5) fungi and miscellaneous (see tables).

An attempt has also been made in these tables to indicate under each species the parts of the plant eaten, locality and seasonal use, availability and the author's estimation of the palatability and relative importance of the article as food. Thus it will be seen from the tables that coniferous trees, although occurring commonly in the habitat of mule deer, have low palatability and are, as a class, little used as food. Contrasted to this, certain species of deer brush and oaks with a wide distribution are both palatable and abundant so that they are much eaten and have a relatively high importance as deer food. Mushrooms and other fungi are eaten at various seasons. Acorns and berries are regular items of diet. Mistletoe, mosses and lichens are eaten when available in winter.

DEER AS EATERS OF GRASS

Many people, including some hunters and a few scientists, maintain that deer do not eat grass. Dr. E. Raymond Hall, in writing on *The Deer of California* (California Fish and Game, vol. 13, 1927, p. 242), states: "As with other deer, grass is seldom touched." Dr. A. W. Sampson, Associate Professor of Forestry at the University of California, and a recognized specialist in grazing studies and range management in the West, in discussing the seasonal variation in the food of mule deer in California in a letter of March 14, 1928, to the author states: "At this time of year grasses, particularly *Bromus hordeacus* and *Bromus rigidus,* constitute in some cases at least three-fourths of the food of deer."

In California there is no question but that at certain seasons of the year fresh green grass is eaten extensively by deer. I have made special efforts to ascertain the facts regarding this disputed point, and have found that at certain seasons when the ground is covered with snow and also in the dry season of early fall, relatively little grass is eaten because at such times green grass is not available. However, a careful observer under such conditions will not jump to the conclusion that grass is "seldom touched," because adequate field investigations have proven that such a statement is not in accord with the real fact. My observations, which have been made in every month of the year, indicate that some grass is eaten whenever it is available and that at certain seasons, fresh green grass forms as high as 90 per cent of the food eaten by mule deer.

On the winter range of mule deer in the upper foothills of California, the rainy season normally begins in October and continues until April or May. This rainy season is accompanied by moderate temperatures in the foothills during the winter, so that the annual grasses germinate and start to grow as soon as the rains begin. Usually, in the foothill region, the annual grasses have developed a new growth of three or four inches in height by Christmas time. This succulent green forage is an important source of food supply to the mule deer on its winter range.

In Yosemite Valley on October 31, 1929, I found a buck working over a pile of fallen black oak leaves. In addition to acorns, which were eagerly sought for, he made special effort to secure the fresh green blades of grass that had grown and developed under the protective covering of leaves.

During the first week of December in 1927 and in 1928, I found all ages and both sexes of mule deer feeding extensively on the blades of freshly-sprouted annual grasses. On February 8, 1930, in Yosemite, I watched two old bucks that had recently shed their antlers and found that they were eating a considerable amount of recently-sprouted annual grasses which, at that time, had reached a height of about one and one-half inches. On this date, I watched two does and five fawns for three hours and found that practically all of their time was spent in grazing on fresh green grass together with an occasional dry oak leaf. Very little browse was taken. On March 28, 1930, at five o'clock in the morning I found deer grazing in the open meadow. By 6.30 o'clock there were 23 there, all feeding on fresh green grass. One buck, two does, and three fawns were carefully observed with binoculars a few feet distant and were found to spend all of their time feeding in warm sunny spots where freshly-sprouted meadow fescue and wild oat grass had reached a height of from two to two and one-half inches. During the entire one and one-half hours that I watched them, these deer fed exclusively on fresh green grass.

On April 29, 1929, in Yosemite, I watched 12 deer for a period of one and one-half hours, during which time they spent the total of 1080 "deer minutes" (one deer minute equals one minute's foraging), feeding on fresh green grass. At this season it was found that the deer spent more time eating grass than all other foods combined.

On May 12, 1929, I watched 13 deer (three bucks, six does and four fawns) as they fed in an open meadow. During the hour that I watched them I had an excellent opportunity to observe that at least 90 per cent of their food at this season consisted of fresh green growing grass which at this date had attained a height of four to six inches. By watching carefully with binoculars at close range, I found that Kentucky blue grass and meadow fescue were being eaten most extensively and that the two together formed about 40 per cent of the food taken, while small annual weeds, too immature and too small to be identified, formed the remaining portion of their diet.

FIG. 117. Dead limbs covered with staghorn lichen are broken off by winter storms. A mule deer fawn is here shown stripping and eating the moss from such a fallen limb. Sequoia National Park, December 19, 1929. Wildlife Division No. 352.

On July 16, 1928, in Yosemite, I watched three large bucks as they grazed in an open meadow. One four-point buck fed steadily for 10 minutes on Kentucky blue grass and for 15 minutes on meadow fescue grass.

Between June 20 and July 2, 1927, I watched 136 different deer feeding for a total of 1217 minutes, and found that green growing grass was selected as food by a larger number of deer than was any other species of plant with the exception of Spanish clover.

A similar condition was found to exist in San Diego County where for many years I found southern mule deer feeding regularly and extensively, in early winter, upon fresh, green and tender wild oats.

AVAILABILITY OF VARIOUS FOODS

A certain species of plant may be palatable and may occur abundantly in the lower foothills of the Sierra Nevada and still have but slight importance as food because it is outside of the mule deer's habitat. Conversely, some preferred plants such at *Ceanothus* may occur abundantly at elevations of 6000 feet in the Sierra Nevada and yet are inaccessible in winter because of being covered with from 3 to 6 feet of snow. However, the same winter storms that snow under the *Ceanothus* thickets break off and bring down on top of the snow tons of green conifer branches, whole clumps of mistletoe and many dead branches that are covered with staghorn lichen or unsea moss. All of these "windfalls" are eagerly sought for and eaten (see Fig. 117). I find that the melting of the snow in the early spring uncovers many fallen

FIG. 118. Green growing milkweed leaves were never noted eaten by deer, but in the fall the dry frosted leaves of this plant were eagerly sought and eaten by bucks, does and fawns. Yosemite, September 17, 1927. Mus. Vert. Zool. No. 5492.

acorns and dead leaves which were unavailable as food during the winter. These hidden items are important to mule deer and are eagerly sought for in early spring. Fungi are eagerly eaten in late summer when they are at hand.

PALATABILITY OF VARIOUS FOODS

In considering the palatability of various grasses, plants, shrubs and trees as food of deer we must take into account all seasons of the year, because a plant which may be scarcely touched under one set of conditions will often be extensively utilized at some other time. For instance, I have watched California mule deer for at least 100 hours feeding amid patches of growing purple milkweed (*Asclepias cordifolia*) without seeing them even taste it. Close inspection of the green plants showed that none was browsed. I was about to conclude that

this milkweed, said by some people to be injurious if eaten by domestic stock, was a total loss as food for deer. However, in the fall after the first hard frost had killed the milkweed plant stalks, I found that the dry leaves were especially sought for and eagerly devoured by bucks, does and even by fawns (see Fig. 118). My final appraisal of the palatability of any given plant is based upon the degree with which deer, at all seasons, utilize it for food (see tables).

SEASONAL VARIATION IN FOOD HABITS

Both seasonal and geographical variation in food preferences of mule deer in California are great. Many pages would be required to give in detail all of my observations on food habits. Since this is not feasible, I am presenting here the outstanding food plants eaten at various seasons of the year. For convenience these food items are treated under four seasonal heads.

SUMMER

In summer, mule deer in California feed to a greater extent than at any other season, upon green leaves, growing herbs, weeds and meadow grasses. Table A presents a fair example of mule deer food in summer.

TABLE A

Food Preferences of California Mule Deer, Yosemite Valley, June 20-July 2, 1927

Determined from actual observation of browsing deer

Common name	Scientific name	Number of deer browsing on plants	Total deer minutes*
Yard grass	*Polygonum aviculare*	19	404
Meadow fescue	*Festuca elatior*	27	362
Spanish clover	*Lotus americanus*	27	345
Western choke cherry	*Prunus demissa*	10	38
California black oak	*Quercus kelloggii*	13	18
Kentucky blue grass	*Poa pratensis*	8	13
Curly dock	*Rumex crispus*	8	11
Horseweed	*Erigeron canadensis*	2	5
Green manzanita	*Arctostaphylos patula*	3	3½
Deer brush	*Ceanothus integerrimus*	3	3
Creek dogwood	*Cornus californica*	1	2
California wild rose	*Rosa californica*	1	2
Bigelow sneezeweed	*Helenium bigelovii*	2	2
Innocence	*Collinsia tinctoria*	2	1½
California laurel	*Umbellularia californica*	3	1¼
Canyon live oak	*Quercus chrysolepis*	1	1
Gooseberry	*Ribes roezlii*	1	1
Black cottonwood	*Populus trichocarpa*	1	1
Yellow monkey flower	*Mimulus primuloides*	1	1
Staghorn lichen	*Unsea*	1	1
Laceweed	*Gayophytum ramosissimum*	1	1
Blue curls	*Trichostema oblongum*	1	½
Total number deer watched		136	
Total actual grazing time (deer minutes)			1217¾

*In computing "deer minutes," the number of deer observed feeding upon any one species of plant is multiplied by the number of minutes spent in feeding. Thus, if two deer browse on curly dock, each for a period of five minutes, the result would be totaled as: curly dock, 10 minutes.

NOTE.—Careful watch was kept to see if any of the deer ate plants said to be poisonous to domestic cattle or sheep. Azalea and larkspur, both said to be poisonous, were not only present but abundant. Cow parsley, said to be nonpoisonous, was also abundant but I have never, during over 100 hours of close observation, seen a mule deer eat any of these plants when green.

In Yosemite on June 21, 1927, from five to six o'clock in the evening, California mule deer were seen eating the following: Deer brush, eaten twice by three deer, total time, 3 minutes; green manzanita, eaten twice by two deer, total time, 1½ minutes; tender leaves of California black oak, eaten three times by three deer, total time, 4 minutes; horse mint, eaten by three deer, total time, 2 minutes. From six to seven o'clock, the four deer fed in the open meadow. Here, meadow fescue grass was the favorite food, being eaten by all four deer for a total time of 60 minutes. The deer fed with their heads down in the grass (see Fig. 82), which was in bloom, nipping off the young, short, tender blades. They did not nip off the heads or tops of the grass as

FIG. 119. A buck feeding on deervetch or Spanish clover. This legume is of outstanding importance among all native plants as summer food for mule deer in Yosemite. Wildlife Division No. 213.

horses and cattle often do. This fact might easily lead one to believe that the deer were not eating grass, but close watch at a distance of 20 feet showed positively that it was being eaten.

Near Royal Arches at 6.30 p.m. on June 23, 1927, several deer were feeding on closely grazed open grass land, so that a clear view could be had. At 20 feet, it was possible, with binoculars, to see clearly that the deer were eating young tender blades of meadow fescue grass exclusively.

On June 24, 1927, in Yosemite, I quietly followed a certain buck at a distance of 10 to 15 feet, when I could see even without binoculars, that he was feeding entirely on yard grass. At this time, all the other deer fed greedily on green leaves on a branch freshly broken from a California black oak.

On June 26, 1927, at seven o'clock in the morning, just before the sun struck the meadow, seven deer were feeding on a low lupine-like plant known as Spanish clover or deervetch (*Lotus americanus*) (see Fig. 119). This legume is, among all native herbs, the most important and is more sought for by California mule deer than any other summer forage plant, a fact that should not be lost sight of in deer management.

On June 26, 1927, I watched and photographed a doe that found a Pacific plum sapling that was out of her reach and "rode" it down, holding the branch with her neck while she ate the green leaves. On the same day at eleven o'clock, on a talus slope near Mirror Lake, I followed a fine sleek buck as he returned twice in 15 minutes and browsed on the green pungent leaves of the California laurel or bay

Fig. 120. These twin fawns hid in a patch of cow parsley and tried to eat grass when four weeks old. Sequoia National Park, August 9, 1933. Wildlife Division No. 3100.

tree (see Fig. 75). Many hunters have told me that this was one tree that deer never eat!

On June 27, 1927, in Yosemite, I found a fine California mule deer buck busily feeding on meadow fescue grass (see Fig. 82). At this time mule deer seem to prefer deervetch and yard weed to other forage in the early morning. Meadow fescue and other grasses were eaten regularly in the evening; thus five deer were each seen to eat meadow fescue grass for as long as 10 minutes at a stretch.

On July 9, 1928, at 5.30 in the morning at the foot of Royal Arches, I found two does feeding on meadow fescue and velvet grass. One of these deer was seen to browse on canyon live oak for two minutes but she stopped twice and took a single bite out of a yerba santa shrub.

On July 10, 1928, at Yosemite, a fawn known to be just thirty hours old, was seen to try to eat the tender young blades of meadow fescue. A single blade was with difficulty nipped off, and several moments were spent in trying to chew it without success. The fawn then turned its attention to some dark dry soil and ate several mouthfuls of it, possibly for the mineral salts it contained. On August 9, 1933, at Round Meadow in Sequoia National Park a pair of spotted fawns about a month old hid in a patch of cow parsley (see Fig. 120) and tried to eat green grass.

I have noted many times that just a few days before they give birth to their fawns, mule deer does search for and eat extra large amounts of green willow leaves. This habit has been noted several

FIG. 121. This pregnant doe ate large quantities of elderberry blossoms just before her fawn was born. Yosemite, July 6, 1929. Wildlife Division No. 200.

times in Yosemite and particularly in Sequoia National Park, in 1933 where I watched nine does that were about to give birth to young. I think that this preference for a diet of willow and other leaves at this particular time helps in some way to prepare the does for the fawn's birth; for as soon as the fawns are born and begin to nurse the does at Sequoia ceased hunting willow leaves and ate a large diet of succulent green grass possibly to produce a good milk supply. In another case at Yosemite on July 6, 1929, I watched a California mule deer doe that was unusually heavy with fawn, as she browsed ravenously on a

velvet elderberry bush. She appeared particularly to crave the clusters of elderberry blossoms devouring four great clusters in as many minutes (see Fig. 121).

On July 2, 1929, I was catching grasshoppers in the meadow to feed to a young California pygmy owl when a pregnant doe heavy with fawn, came up and begged to be fed. My young daughter asked me to give this deer some grasshoppers to eat. I replied that deer were vegetarians, but when I held out a nice, fat grasshopper, the doe came up and took it, chewed it awhile and then swallowed it. She then followed me begging for more. I gave her two more grasshoppers which she ate with avidity. She later ate both grasshoppers and green katydids but seemed to prefer the grasshoppers. Her unusual appetite may have been due to her pregnant condition.

FIG. 122. This large yellow evening primrose is a favorite food of mule deer and has, through deer eating it, become almost extinct in Yosemite Valley, outside of fenced areas. Yosemite, July 10, 1928. Mus. Vert. Zool. No. 5778.

In Yosemite on July 6, 1929, I watched one doe that made a special hunt for young seedlings of the California black oak hidden under a thick carpet of fallen leaves. During one 20-minute period, 7.50 to 8.10 a.m., I found that she located the hidden seedlings by aid of her nose. These oak seedlings were then about three inches high, above the acorn, and the tap root extended down about the same distance. The doe sought and ate the sprouted acorn, both halves of which remained tightly attached to the middle stem of the seedlings. In 20 minutes this doe found eleven oak seedlings and ate the sprouted acorns from all of them. In six instances the seedlings were pulled up and destroyed.

In Yosemite Valley when I first visited it, nearly 20 years ago, deer were rare there and in certain spots great fields of tall yellow evening primrose covered large areas (see Fig. 122). There were originally acres of evening primroses in Yosemite Valley. As the mule deer increased, under total protection, they ate more and more of the primrose plants until by 1929, I was able in two weeks' search to find less than six plants outside of fenced gardens. Even in the native wild flower garden at the Ahwahnee Hotel, protected by a supposedly deer-proof fence, I found that with all sorts of native grasses, clovers and herbs present, the deer that managed to "overcome" the fence,

first sought out, ate and destroyed all of the evening primrose plants. They next attacked and ate most of the leaves and tender shoots of a bed of thimble-berry bushes that had been carefully reared there.

On July 16, 1927, I photographed a large four-point buck that was making a meal of the tender, growing frond tips of the common brake or fern (see Fig. 123). The tips of this fern are eaten regularly by California mule deer.

Mule deer browse some even in mid-summer. This was demonstrated by a doe observed and photographed on July 1, 1927, while she was browsing in a thicket of western choke cherry (see Fig. 124),

FIG. 123. The tender growing tips of the common brake fern are regularly eaten by mule deer as here shown. Yosemite, July 16, 1928. Mus. Vert. Zool. No. 5709.

and also by a buck which was photographed while he was browsing on a willow on July 4, 1929 (see Fig. 126).

On July 23, 1929, at an altitude just under 10,000 feet at the western base of Mount Dana, I found fresh tracks of six deer, all being of medium size with no large tracks of bucks. By following these tracks I found freshly cropped vegetation which showed that the deer had browsed along the edge of a green meadow and had eaten both grass and shrubs particularly certain alpine willows. In the Mount Whitney region on August 23, on a divide at the very head of Kern River, I found where a large Inyo mule deer buck had crossed a divide at 12,150 feet coming over from the east side. Here again

certain low alpine willows had been browsed so that a decided preference appears to be shown for such shrubs in late summer at high altitudes in the Sierra Nevada.

FALL

I have found that mule deer in California feed heaviest upon weeds during the fall months. The term "weeds" is here used in the agricultural sense, referring to certain herbs which seriously interfere with agricultural pursuits. Mule deer are fond of many species of such "weed" plants which the rancher or orchardist considers as

FIG. 124. A California mule deer doe browsing on western choke cherry. Note that all leaves have been eaten to a height of 54 inches. Yosemite, July 1, 1927. Mus. Vert. Zool. No. 5404.

nuisances. Weeds such as tumble-weed, horseweed and curly dock are kept pruned back by deer, the repeated nippings keeping a fresh supply of tender growth coming on in the dry season especially in late summer and early fall when green food is at a premium. Golden rod, sagewort, mugwort and even that fern pest, the common bracken, are all eaten extensively in the early fall. Even milkweed is then eaten.

Among the shrubs we find that buck brush and snow brush which have been lightly utilized during the summer are heavily utilized by mule deer in the fall. In many instances, I have found that poison oak, gooseberry bushes and especially Nevada currant bushes are most heavily consumed by mule deer in the early fall.

The following table has been selected as showing typical food preferences of California mule deer in September.

TABLE B

Food Preferences of California Mule Deer, Yosemite, September 13–18, 1927

Determined by actual observation of deer eating each plant.

Plant and scientific name	No. of deer seen eating this plant	Total deer minutes
Deer brush, *Ceanothus integerrimus*	5 does	150
Velvet grass, *Notholcus lanatus*	20 bucks, does, many fawns	95
Dragon sagewort, *Artemisia dracunculus*	20 bucks, does	90
California black oak, *Quercus kelloggii*	6 does, fawns	90
Western golden rod, *Solidago occidentalis*	15 bucks, does	60
Tumble-weed, *Amaranthus graecizans*	4 does	60
California mugwort, *Artemisia heterophylla*	8 bucks, does	55
Common golden rod, *Solidago californica*	10 bucks, does	30
Lessingia, *Lessingia leptoclada*	5 does	30
Western choke cherry, *Prunus demissa*	3 does	30
(Wire) buckwheat, *Eriogonum virgatum*	4 does	20
(Slender) buckwheat, *Eriogonum nudum*	3 does	16
Creek dogwood, *Cornus c. californica*	2 does	10
Milkweed, *Asclepias cordifolia*	2 does, buck	10
Horseweed, *Erigeron canadensis*	1 fawn	10
Common brake, *Pteris aquilina*	2 bucks	5
Curly dock, *Rumex crispus*	1 doe	5
Mountain hemp, *Apocynum androsaemifolium*	2	2
Canyon live oak, *Quercus chrysolepis*	1 buck	2
Gooseberry, *Ribes roezlii*	1 doe	2
Meadow fescue, *Festuca elatior*	5 fawns	
Total deer watched	120	
Total actual grazing time (deer minutes)		850

In the Lassen section, at 6600 feet on Warner Creek in Shasta County, on September 24, 1923, I found that nearly all of the Rocky Mountain mule deer were feeding on currant bushes which grew abundantly on rocky talus slopes. Earlier in the season these currant bushes had been little eaten by the deer but as soon as the leaves began to turn yellow in the fall, then they were eagerly sought for and devoured in great quantities. At this same date mule deer in the Lassen Peak region were starting to browse heavily on snow brush and huckleberry oak. One large buck, killed by a local hunter, had his stomach nearly full of finely-chewed huckleberry oak leaves. In the late fall at Eagle Lake, Lassen County, considerable tobacco brush is eaten by Rocky Mountain mule deer.

On October 7, 1924, five miles north of Fredonyer Peak in Lassen County, I followed a large Rocky Mountain mule deer buck for several hours as he leisurely fed in early morning across a sage-covered flat. He had browsed along eating the leaves of antelope brush in preference to all other forage, with mountain mahogany second choice. On October 15, 1924, at Observation Peak, in extreme eastern Lassen County I found that mule deer were feeding almost entirely on mountain mahogany which grew abundantly there. On the California-Nevada State line north of Observation Peak, I found that antelope brush (*Purshia*)

known locally as "buck" brush grew abundantly and served as the principal food of Rocky Mountain mule deer in that region in late fall and winter.

On September 24, 1924, at Hackamore Reservoir in Modoc County, I examined two dead Rocky Mountain mule deer, a four-point buck and a doe, and found their stomachs over half full of mud that they had eaten. Vegetation found in these deer stomachs consisted of service berry leaves, 20 per cent; and manzanita leaves, 20 per cent; mud, 60 per cent, made up the rest of the stomach contents. Stomach contents of a dead fawn at this locality consisted almost entirely of manzanita leaves. The intestines of these two adult deer contained only mud which may have been eaten because of the lack of salt.

FIG. 125. California mule deer doe eating tumble-weed. Mule deer are fond of many agricultural weeds, especially in late summer and early fall. Yosemite, September 15, 1927. Mus. Vert. Zool. No. 5500.

In Yosemite, on September 15, 1927, four California mule deer does were watched and photographed as they returned repeatedly to browse on a green tumble-weed (see Fig. 125). Another doe nearby was found feeding on the leaves and twigs of a gooseberry bush (see Fig. 127). At this time in Yosemite, mule deer were feeding more extensively on deer brush than on any other forage plant (see Fig. 128).

This greatly increased use of *Ceanothus* by mule deer in the fall has been noted and recorded by the writer dozens of times in the Lassen, Yosemite and Sequoia sections of the Sierra Nevada as well as in the mountains of southern California. It is my conclusion, after 30 years' experience, that *Ceanothus* is without doubt the most important genus of forage plants for deer in California. Wm. A. Dayton, in his *Important Western Browse Plants* (Miscellaneous Publication No. 101, July, 1931, U. S. D. A.) considers *Ceanothus integerrimus* as "probably the most important single browse species in California." It has been my experience that this holds for deer, as well as for cattle and sheep. However, several other species of *Ceanothus* are nearly as important to mule deer as *integerrimus*. As authorities do not agree on common names for *Ceanothus* I am forced here to use scientific names in order to be definite. In the Lassen, Yosemite and even in Sequoia sections *Ceanothus cordulatus* known as snow brush or white thorn is abundant over hundreds of square miles, being more abundant, if not

FIG. 126. California mule deer browsing on green willow leaves. Yosemite, July 4, 1929. Wildlife Division No. 214.

FIG. 127. This mule deer doe fed regularly on gooseberry bushes in the fall. Yosemite, September 15, 1927. Mus. Vert. Zool. No. 5497.

quite so palatable, as *integerrimus*. As far as deer are concerned, I can not agree with Dayton's statement, p. 108, that *cordulatus* is "distinctly inferior as a browse." In southern California *Ceanothus divaricatus* is an important browse shrub for southern mule deer. It has been my experience that in Lassen and Modoc counties, tobacco brush (*Ceanothus velutinus*) is eaten rather extensively at times in the fall by Rocky Mountain mule deer so I can not agree with Dayton's statement, p. 110, that this species is "except for limited use by goats, worthless as browse." Another species of deer brush (*C. diversifolius*) is an important browse shrub but grows at the lower elevations and hence is used chiefly by Columbian black-tailed deer.

FIG. 128. Mule deer browse lightly on *Ceanothus integerrimus* in summer but utilize it heavily in the fall and early winter as here shown. Yosemite, September 15, 1927. Mus. Vert. Zool. No. 5498.

Among the California mule deer in Yosemite, I find that utilization of such plants as sneezeweed, horseweed and California mugwort is most marked in September (see Fig. 129). Even milkweed leaves which had remained untouched all summer were eagerly sought for when killed by frost in the fall (see Fig. 118). By September, fruits of Pacific service berry, bitter cherry and other shrubs become ripe and are eaten extensively at times. Acorns begin to mature and drop at this season but although they are eaten extensively in late fall by mule deer, they become more important in early and late winter. Among the several varieties of oak trees that provide acorns (see tables), I would

place California black oak and scrub oak among the first with canyon live oak and California blue oak in secondary rank. Huckleberry oak is more utilized for its leaves than for its acorns.

In early fall, green grass and other succulent herbage is especially important to fawns that are being weaned. On September 18, 1927, in Yosemite, I watched two spotted fawns feeding by themselves in the edge of the meadow. Their mother had slipped away in an effort to wean them. The fawns were hungry and selected the tenderest grass blades which were eaten exclusively (see Fig. 102). The middle of September, or weaning time, is an important period in the life of a mule deer fawn. When a doe begins to wean her fawn, if a suitable supply of green grass or other green forage is absent it frequently

FIG. 129. A California mule deer buck eating sneezeweed and horseweed. Yosemite, September 14, 1927. Mus. Vert. Zool. No. 5479.

means that the fawn will continue to nurse and thus will be a drag on its mother and both she and fawn enter the winter in poor condition and in several known instances did not survive (see Fig. 103).

On October 31, 1929, in Yosemite, I watched a large four-point buck for an hour as he picked up stray tufts of grass that had been hidden and covered by fallen leaves. I was surprised to find that 60 per cent of what he ate during the hour consisted of fallen leaves of California black oak, many of which had just been blown off the trees. Many brown dry oak leaves were also eaten. Acorns of the California black oak were eagerly sought for and formed 30 per cent of the food eaten during the hour. Considerable fresh green grass was also eaten.

I found that the mule deer were able to tell and reject faulty *i.e.* wormy or blank acorns without even touching them.

In Sequoia National Park, I observed that squaw-root (*Carum gairdneri*) often known in the West as "Queen Anne's lace," and is quite different from "Queen Anne's lace" of eastern United States, and grows abundantly in both Round Meadow and Crescent Meadow forming a white "bedspread" over the meadows. Late in September, 1933, the white flowering heads of this plant were extensively eaten by mule deer.

WINTER

Winter months constitute the lean season for mule deer. By the first part of the winter, the deer have usually come down from the

FIG. 130. Buck eating *dead* sedge *in winter*. Sedge was rarely eaten in summer. Sequoia National Park, December 18, 1929. Wildlife Division No. 210.

high summer range and are found at low altitudes in the foothills. Normally, the seasonal fall rains insure a good growth of fresh annual grasses in the foothills by December and this green food supply is heavily utilized to supplement their diet of browse. This heavy utilization of green grass in early winter by both California and southern mule deer has been set forth at length under the chapter on "Deer as Eaters of Grass." It may seem paradoxical, but fresh green grass is an important and regular article of diet of mule deer in winter in central and southern California.

For the Rocky Mountain mule deer which winter east of the Sierra Nevada, green grass is in winter just a memory. In Sequoia National Park, on December 18, 1929, I explored an acre thicket of

snow brush (*Ceanothus cordulatus*) that grew on a warm, sunny slope high on a warm ridge. There was a dense thicket of bitter cherry growing just below the snow brush but the deer, two big bucks, two does and three fawns, were all browsing on the leaves and twigs of snow brush. In a meadow nearby the mule deer were eating large quantities of dead, soggy *Carex* stalks. These deer had used this sedge only at rare intervals while it was green and growing, but in the fall after the sedge had become dry and frosted and then soaked up for several weeks by rain and snow until it had become soft like ensilage the deer ate it greedily (see Fig. 130). Does, bucks and fawns all were observed to eat the dead moist stalks of sedge (*Carex*) that had been killed by frost and matted down in shallow water.

Typical food preferences of mule deer at Giant Forest, observed on December 18, 1929, were as follows:

2 does ate sedge (*Carex*) 50 deer minutes.
1 buck ate sedge (*Carex*) 20 deer minutes.
2 does ate snow brush (*C. cordulatus*) 90 deer minutes.
3 fawns ate snow brush (*C. cordulatus*) 90 deer minutes.
2 bucks ate snow brush (*C. cordulatus*) 120 deer minutes.
1 fawn ate chinquapin (leaves) 15 minutes.
2 does, 1 buck and 2 fawns ate staghorn lichen.

Staghorn lichen or unsea moss is an important winter food. Repeated observations in winter revealed that even fawns nibble the moss from fallen limbs and in several instances I have seen deer expectantly waiting until they heard the crash of a fallen limb, whereupon they went directly to the spot and ate the lichen (see Fig. 117). The lichen has an acid flavor not unpleasant to the taste.

In both Sequoia and Yosemite, as well as in San Diego County, I have observed that in January the dead, dry leaves of the California black oak are seldom eaten. However, as soon as it rains or snows and these leaves become moist and soften a bit, the deer eat them in large quantities. Leaves that become matted down and moist from contact with the damp ground are often pawed or rooted up and eaten. Even the fawns locate and eat these leaves after rooting about in the snow (see Fig. 74). The older deer sometimes paw the snow away in order to get at both dead leaves and acorns. On January 30, 1929, in the Yosemite region, I found that acorns from California black oaks formed the chief diet. These acorns were sought for amid the fallen leaves by bucks, does and fawns. The deer are evidently able to detect defective acorns, for without fail I found that a wormy acorn or a blank acorn that contained no meat was always rejected. As a test I experimented by throwing a handful of good acorns broadcast on the ground where the earth was already littered with blank or defective ones. The good acorns were picked out unerringly by the deer while I observed them with binoculars. Now and then a deer would miss a good acorn, but it did not pick up the blank acorns, not touching or coming within

four or five inches of them. I could not tell the good acorns by looking at them or by smelling them but had to test them by weight, but the mule deer know their acorns. Many of the does hunted for acorns at the margins of melting snow banks (see Fig. 131).

In eating acorns, the deer pick them up daintily taking care that no gravel, sticks or stones are included. The acorn is then munched carefully and in from 30 to 60 seconds the hull or outside covering is dropped, sometimes in two or three large pieces, but usually in several smaller ones. The meat of the acorn is then chewed into a fine pulp and swallowed. Old bucks appear to be most appreciative of acorns

Fig. 131. Many deer hunt in late winter for fallen acorns at the margins of melting snow banks, as here shown. Yosemite, January 30, 1929. J. S. Dixon No. 1.

but does and fawns spend considerable time hunting for them under snow and dead weed stalks (see Fig. 132). If they get their nose within four inches of an acorn they usually locate it, but at times they miss good acorns in plain sight within a foot of their nose.

I found that buck brush (*C. cuneatus*) is utilized heavily by mule deer in winter when heavy snows crowd them down into the lower winter range. Yerba santa is likewise largely browsed at this season, many of the bushes being stripped of all their leaves and even all of the twigs and shoots to the size of a lead pencil are eaten. Most of the yerba santa bushes are not browsed on to any extent until heavy snows

come when the deer go after them in earnest. One buck on January 31, 1929, spent 15 minutes at a stretch nibbling at twigs of a yerba santa bush.

Green manzanita bushes are likewise heavily utilized in winter and on January 31, 1929, I found that many of these were being stripped of all foliage up to a height of 60 inches which is about as high as a deer can reach with his front feet on the ground.

Scrub oak is another important food plant in winter. Acorns are usually a heavy crop on scrub oaks and these together with the leaves of this oak are in my experience about the best and most dependable food supply of southern mule deer in winter.

A study of the food habits of burro deer which I made late in December, 1930, in the Chocolate Mountains showed that these were feeding along the desert washes chiefly on palo verde, ironwood (*tesota*), catclaw and mistletoe. Previous investigation along the Colorado River near Blythe, determined that in the fall burro deer feed extensively on the pods and leaves of honey mesquite.

FIG. 132. Doe and fawn hunting for acorns under snow and amid dead weed stalks. Yosemite, December 9, 1932. Mus. Vert. Zool. No. 5642.

SPRING

In late winter and early spring, California mule deer feed largely on willows, of several species, as well as manzanita and certain coniferous trees such as white fir, incense cedar and western yellow pine. Acorns of the California black oak are important in spring as are also tender blades of newly sprouted wild oats and annual grasses.

The following notes were taken March 28, 1930, in Yosemite.

	Eaten by	Total deer minutes
Meadow fescue and wild oats	6 deer	30
Meadow fescue	6 deer	90
Wild oats	6 deer	90
Willow (fallen branch)	3 deer	9

On April 29, 1929, in Yosemite, I saw mule deer eat:

	Eaten by	Total deer minutes
California black oak (acorns)	8 deer	80
Western choke cherry (green shoots)	2 deer	16
Meadow fescue (3 inches high)	12 deer	1080
California laurel (leaves)	1 deer	3
Green manzanita (leaves)	2 deer	5
Willows (green twigs and buds)	10 deer	70

FIG. 133. A buck mule deer browsing on Mariposa manzanita. Yosemite, March 29, 1930. Wildlife Division No. 786.

On this date, I found all of the does and fawns hunting acorns under the black oaks at the edge of the meadow. They went about rooting amid dead fallen leaves for acorns that had recently been uncovered by the melting snow banks. Willow twigs were much sought for at this time. The willows had not yet leafed out but the deer were making special efforts, many of them standing up on their hind legs and breaking down the taller branches so as to feed on the yellow buds. In certain instances the deer were seen to straddle and ride down slender saplings or to hold a branch down with their necks while feeding on the willow buds.

On March 28, 1930, in Yosemite at 8.35 a.m., I watched an old buck browse on the lower branches of a young white fir. This buck reached up and at one time stood goat-fashion, with his front feet placed on a horizontal limb, browsing to a measured height of 66 inches. This buck then stood up on his hind legs and getting his neck over some of the lower, limber branches, held them down while he bit off the tender tips. When these branches were finally released, they sprang back to their natural position eight feet above the ground.

On March 30, 1930, I found a young western yellow pine about 30 inches tall that had been repeatedly browsed by mule deer so that no needles were left (see Fig. 116) and the tree had died.

On March 26, 1929, deer in Yosemite were found to be feeding largely on mistletoe that had been knocked or blown off the California

FIG. 134. A California mule deer doe climbing up to browse on green leaves of manzanita which is chiefly utilized in winter. Yosemite, March 29, 1930. Wildlife Division No. 564.

black oaks. On April 6, 1929, deer were seen eating incense cedar boughs and green manzanita. On March 27, 1930, in Yosemite, one mule deer was seen browsing on Douglas fir for three minutes and another one fed on white fir for a similar period. On this day, practically all of the deer in Yosemite were observed to be feeding largely on grass just starting to grow. At 6.30 o'clock on the morning of March 28, 1930, I counted 23 California mule deer out feeding along the edge of the meadow. I watched one buck, 2 does and 3 fawns closely and found that they spent all of their time feeding on warm, sunny exposures under the oaks where wild oats and other annual

grasses grew from 2 to 2½ inches high. They fed exclusively on these grasses. On March 29, 1930, at 6.15 in the morning, I watched an old buck browse continuously for eleven minutes on the leaves of the Mariposa manzanita. The lower limbs had all been stripped of leaves to a height of 60 inches so that the buck had to stretch to the utmost to

FIG. 135. A California mule deer doe standing on her hind legs to browse on green leaves of California buckeye. Sequoia National Park, April 21, 1933. Wildlife Division No. 2990.

reach fresh forage (see Fig. 133). A few minutes later I watched an old doe browse for seven minutes at a time on green manzanita (see Fig. 134). The Mariposa manzanita was the commoner form at this particular point, and nearly every clump of it was browsed as high as deer could reach keeping their feet on the ground. The manzanitas

are too stiff and too brittle for the deer to "ride" down as they do the willow saplings.

At Hospital Rock in Sequoia National Park on April 21, 1933, I watched a doe repeatedly stand up on her hind legs in order to eat fresh, green leaves of the California buckeye (see Fig. 135). This unusual food preference was apparently due to the overbrowsed condition of the range at that place as I have rarely found deer eating buckeye leaves until they become yellow and drop from the trees.

COMPETITION WITH HORSES, CATTLE, SHEEP AND GOATS

Some claim that there is little or no competition for food between mule deer and domestic stock. Those who have studied the matter thoroughly think otherwise. Dr. A. W. Sampson, a recognized authority, in his investigation of food habits of deer in California, found that in 46 species, embracing 6 genera, of food plants eaten by deer that 38, or 82 per cent, are palatable to sheep; 33 or 71 per cent are of value as food for goats; 25 or 54 per cent are eaten by cattle and 16 or 34 per cent are grazed by horses.

My own conclusions coincide quite closely with Dr. Sampson's except that I find that if we consider the utilization of trees such as scrub oak and such thorny shrubs as gooseberry and *Ceanothus*, then food preferences of mule deer are most nearly like those of goats. Among the herbs, there is serious competition between deer and sheep and there is competition in the grasses between both horses and cattle and deer. Turning to the genus *Ceanothus* which is, I believe, correctly evaluated by Dayton in his *Important Western Browse Plants*, p. 106, as the "most important single browse species in California," we agree that mule deer prize and utilize this shrub to even a greater extent than do either cattle or sheep. The same, in my experience, is true of antelope brush or bitter-brush (*Purshia tridentata*) which probably shares second place with western choke cherry and Pacific service berry and creek dogwood. These last three species are utilized much more by mule deer than by cattle or sheep and with better results since I have never known a mule deer to suffer any poisonous effect from eating any of them.

ESTIMATED PALATABILITIES

Grasses	U. S. Forest Service		Dixon, Yosemite
	Cattle	Sheep	Deer
Agrostis, Red-top grass	80	50	70
Poa, Blue grass	90	70	70
Phleum, Timothy	90	70	65
Herbs			
Achillea, Yarrow	20	40	50
Aster, Aster	20	40	50
Heracleum, Cow parsnip	30	70	10
Heuchera, Alum root	0	10	30

Shrubs	U. S. Forest Service Cattle	U. S. Forest Service Sheep	Dixon Yosemite Deer
Amelanchier, Service berry	50	70	75
Ceanothus, Deer brush	80	85	90
Cornus, Dogwood	5	10	30
Populus, Aspen	50	50	60
Prunus, Choke cherry	30	30	75
Ribes, Gooseberry	10	20	30
Salix, Willow	30	70	40

Mule deer in California utilize heavily both *Ceanothus cuneatus* and *Ceanothus cordulatus*. Dayton reports, p. 111, that where *cuneatus* has been "grazed extensively, it has a bad effect on the animal's kidneys, especially the male live stock." No such ill effect on mule deer, which feed extensively on these species in fall and winter, has been found by me.

Since it has been definitely shown that deer and domestic stock, particularly sheep and goats, do compete seriously for food or browse on the range, this fact should be fully considered in any proposed plan of range management of our National forests, National parks and on the public domain.

CULTIVATED CROPS EATEN BY MULE DEER IN CALIFORNIA

It has been my experience that most of the damage caused by deer to cultivated crops in California is due to depredations of Columbian and southern black-tailed deer rather than mule deer. This is due to the fact that for the most part, mule deer live in rough mountainous areas at higher altitudes where there is a minimum of farming operations. The mule deer is also wilder by nature and has not had such close association with man as has the coast black-tailed deer.

However, damage to deciduous orchards, to vineyards, to truck and to other field crops is sometimes caused by both California and southern mule deer. Most of such damage known to me has been in the foothill sections of the southern Sierra Nevada and in the mountainous parts of San Diego County where I spent several years on a mountain fruit ranch.

Items are here listed in order of frequency of attacks: Among orchard crops, prune, apple, pear, apricot, peach, cherry, plum and almond trees were known to be eaten and damaged by mule deer. Prune trees suffered most severely.

Among truck crops, watermelons, casabas, cantaloupes, squash, corn, cabbage, carrots, potatoes and beans were the main items damaged by deer.

Among forage crops, alfalfa, clover, vetch, oats, barley and wheat.

Among vineyard crops, mission and other wine grapes suffered most followed by tokay, muscat and Thompson seedless. Eastern table grapes such as Concord and Isabella, suffered least of all.

For a full discussion of this subject of *Damage by Deer to Crops in California* see CALIFORNIA FISH AND GAME, April, 1932, pp. 136–147.

GAME MANAGEMENT

Game management is primarily concerned in securing sustained annual crops of wild game for recreational use. In order to accomplish this, we must know the life history, food habits and other requirements of the game species to be produced.

In general, it may be said that food, shelter and safe breeding places are three most essential requirements. In the case of mule deer in California we must consider in our game management plan:

1. Control of hunting.
2. Control of predatory animals.
3. Control of food and water.
4. Control of disease and parasites.
5. Control of game refuges and cover.
6. Competition with domestic cattle, sheep and goats.

I feel that control of hunting is fairly well provided for under our existing California game laws, but constant watch must be kept to see that closed seasons, bag limit and laws preventing killing of does and fawns are observed by hunters. It may become necessary to reduce the bag limit to one buck per season in districts 4, 4½ and 4¾.

In regard to control of predatory animals, the fine work that has been done by State Lion Hunter Jay Bruce and other men together with the substantial bounty paid on mountain lions by our California Fish and Game Commission has, I believe, been of greatest importance. In southern California, certain counties have paid an additional bounty which has brought the total up to over $50 per lion so that it is believed that this greatest natural enemy of the mule deer is adequately cared for.

Experience may show that further control of coyotes on the "fawning grounds" of the mule deer in California may be good game management. In so far as concerns mule deer, I doubt if any further control of wildcats and golden eagles is justifiable at this time.

It has been my experience that in the Modoc region development and protection of the relatively scant water supply is highly desirable since in many places living springs are rare and far apart. There are, in my experience, many areas in this region that would support a decidedly larger deer population if an adequate water supply could be provided. Ten miles is about the maximum distance that mule deer naturally forage from water and I believe that for best results the "cruising radius" of mule deer should be less than five miles.

Under present grazing practice the salt logs which are provided on the range for domestic sheep and cattle automatically provide sufficient salt for deer also. However, I believe that on game refuges and elsewhere where salting of domestic stock is not practiced, salt logs should be provided especially for deer.

The tragic experience and slaughter of over 22,000 deer in the Stanislaus National Forest which were infected with the foot-and-mouth disease from range cattle should be a constant warning to us of

dangers from such sources. The ordinary diseases and parasites of mule deer are relatively difficult to treat and to control, but epizootics of foot-and-mouth disease in our wild deer of California are probably preventable, since they were unknown among our native deer prior to their introduction by infected domestic stock.

Control and maintenance of the range is of most vital importance. In reality our capital game investment lies in the range or food supply of our mule deer. If the carrying capacity and productivity of the range is kept up to a high standard, it will be possible to maintain a good annual crop. Therefore, an equitable division of forage, particularly of browse, must be made between domestic stock and wild deer. If the range is allowed to be depleted as on the Kaibab Plateau by both domestic stock and deer, it will take years to restore the forage. All of the deer in the world will avail us but little if we lack forage and range to sustain them.

EXPLANATION OF FOOD TABLES

In the following tables, I have tried to give in condensed form, the main points of interest relating to some 200 different kinds of trees, shrubs, herbs, sedges, grasses and fungi known to have been eaten by mule deer in California. To some this may seem a large number of food plants for one kind of deer to eat, but several geographic races and several life zones are involved. Although the data here presented represent many years of close observation of food habits, I doubt if I have discovered half of the plant species that are eaten by mule deer in California.

I expect that the experience of other observers may vary from mine. I have several times been ready, after months of observation, to conclude that a certain plant was rarely, if ever, eaten by mule deer. Then going out at some unusual season, I have found this same plant highly utilized as food. To get a true estimate of relative values of food plants, the observer must follow the deer every month in the year.

In compiling these tables I have followed: Sudworth, *Check List of the Forest Trees of the United States,* U. S. D. A., Misc. Circ. No. 92, March, 1927, with supplemental list for trees. For all other plants, I have tried to follow Jepson's *Manual of the Flowering Plants of California,* 1925. Among the herbs, it frequently happened that Jepson gave only the scientific name of the plant, no common name being given. In a few instances of this sort, I have had to use the best common name that I could find. In one or two instances, notably in the genus *Lotus* I have rebelled and have used the name "deervetch" because of the great importance of this genus as forage for mule deer in California.

In the tables, "Chief Seasonal Use" does not mean that the plant is not used at other seasons. Availability is based upon relative abundance and accessibility of a given plant within the range of the mule deer in California. Thus an annual that might be abundant in summer on the winter range of mule deer might have little importance

as food because of the animals being absent at that season in the higher mountains.

Under "Locality," I have given a main use locality. In some instances, utilization may have been noted in a dozen different localities.

"Relative Importance" of a forage plant is based upon all of the above factors and is given as the writer's opinion in the last column.

TABLE I

TREES BROWSED BY VARIOUS RACES OF MULE DEER IN CALIFORNIA

Name	Parts eaten	Locality and chief seasonal use	Availability	Palatability	Relative importance
Western white pine, *Pinus monticola*	Needles and terminal tips	Sequoia, summer	Medium	Low	Slight
Sugar pine, *Pinus lambertiana*	New needles and terminal shoots	Yosemite, fall	Common	Low	Slight
Singleleaf pinon, *Pinus monophylla*	Needles, nuts and branch tips	Mono Lake, fall	Medium	Low	Slight
Foxtail pine, *Pinus balfouriana*	Needles and branch tips	Sequoia, summer	Medium	Low	Slight
*Western yellow pine, *Pinus ponderosa*	Needles and terminal tips	Yosemite, winter	Common	Fair	Fair
Jeffrey pine, *Pinus jeffreyi*	Needles and terminal tips	Sequoia, summer	Common	Low	Slight
Lodgepole pine, *Pinus contorta*	Needles and terminal tips	Lassen, summer	Common	Low	Slight
Digger pine, *Pinus sabiniana*	Needles and terminal tips	Yosemite, winter	Common	Low	Slight
Coulter pine, *Pinus coulteri*	Needles	San Diego, winter	Rare	Low	Slight
Douglas fir, *Pseudotsuga taxifolia*	Needles and branch tips	Yosemite, fall	Common	Low	Slight
*White fir, *Abies concolor*	Needles and branch tips	Sequoia, fall	Common	Fair	Fair
California red fir, *Abies magnifica*	Needles	Sequoia, summer	Medium	Low	Slight
Big tree, *Sequoia washingtoniana*	Terminal tips	Sequoia, summer	Rare	Low	Slight
Incense cedar, *Libocedrus decurrens*	Tips of branches	Yosemite, spring	Common	Fair	Fair
Western juniper, *Juniperus occidentalis*	Tips of branches	Lassen, winter	Common	Low	Slight
*Aspen, *Populus tremuloides*	Leaves, buds, sprouts	Sequoia, fall	Common	Good	Fair
Black cottonwood, *Populus trichocarpa*	Leaves, buds, sprouts	Yosemite, spring	Medium	Fair	Fair
Dudley willow, *Salix gooddingii*	Leaves and sprouts	Yosemite, spring	Common	Fair	Fair
Red willow, *Salix laevigata*	Leaves and sprouts	Yosemite, spring	Common	Fair	Fair
Western black willow, *Salix lasiandra lancifolia*	Leaves and shoots	Sequoia, spring	Common	Fair	Fair
Narrowleaf willow, *Salix exigua*	Buds	Mono Lake, spring	Medium	Fair	Slight
White willow, *Salix lasiolepis*	Leaves, buds	Sequoia, spring	Common	Fair	Fair
Scouler willow, *Salix scouleriana*	Buds, leaves	Yosemite, spring	Medium	Fair	Fair
Mountain alder, *Alnus tenuifolia*	Buds, leaves	Lassen, summer	Medium	Low	Slight
White alder, *Alnus rhombifolia*	Leaves, shoots	Yosemite, fall	Medium	Low	Slight
Golden chinquapin (?), *Castanopsis chrysophylla*	Leaves	Sequoia, fall	Common	Fair	Fair
Tan oak, *Lithocarpus densiflora*	Leaves, acorns	Yosemite, winter	Rare	Good	Slight
*California black oak, *Quercus kelloggii*	Leaves, acorns, seedlings	Yosemite, winter	Common	Excellent	Great

Highland live oak, *Quercus wislizenii*	Leaves, acorns	Sequoia, winter	Medium	Good	Fair
Canyon live oak, *Quercus chrysolepis*	Leaves, acorns	Yosemite, winter	Medium	Good	Fair
*Huckleberry oak (?), *Quercus vaccinifolia*	Leaves, acorns	Lassen, fall	Medium	Excellent	Great
*California scrub oak, *Quercus dumosa*	Leaves, tips, acorns	San Diego, winter	Common	Excellent	Great
California blue oak, *Quercus douglasii*	Leaves, twigs, acorns	Sequoia, winter	Common	Good	Fair
Valley white oak, *Quercus lobata*	Leaves, acorns	Sequoia, winter	Medium	Good	Fair
California laurel, *Umbellularia californica*	Leaves	Yosemite, spring	Medium	Low	Slight
Christmas berry, *Heteromeles arbutifolia*	Leaves, twigs	Yosemite, winter	Medium	Fair	Slight
*Pacific service berry, *Amelanchier florida*	Leaves, twigs, fruit	Yosemite, fall	Common	Excellent	Great
*Curl-leaf mountain mahogany, *Cercocarpus ledifolius*	Leaves, twigs	Lassen, winter	Common	Good	Great
Birch-leaf mountain mahogany, *Cercocarpus betuloides*	Leaves, twigs	Sequoia, fall	Medium	Good	Fair
Pacific plum, *Prunus subcordata*	Leaves, twigs, fruit	Yosemite, fall	Medium	Fair	Fair
*Bitter cherry, *Prunus emarginata*	Leaves, twigs, fruit	Sequoia, fall	Common	Good	Great
*Western choke-cherry, *Prunus v. demissa*	Leaves, twigs, fruit	Yosemite, fall	Common	Good	Great
Catclaw, *Acacia greggii*	Leaves, twigs, pods	Chocolate Mts., fall	Rare	Fair	Slight
*Honey mesquite, *Prosopis j. glandulosa*	Leaves, twigs, pods	Colorado River	Medium	Excellent	Great
Screw-bean, *Prosopis odorata*	Leaves, twigs, beans	Chocolate Mts., fall	Medium	Excellent	Fair
California red-bud, *Cercis occidentalis*	Leaves, twigs	Yosemite, winter	Rare	Low	Slight
Paloverde, *Cercidium torreyanum*	Twigs	Chocolate Mts., winter	Common	Good	Fair
*Tesota, *Olneya tesota*	Leaves, twigs, pods	Chocolate Mts., winter	Common	Good	Great
Dwarf maple, *Acer glabrum*	Sprouts, leaves, twigs	Sequoia, fall	Common	Fair	Fair
California buckeye, *Aesculus californica*	Dead leaves (chiefly)	Sequoia, fall	Common	Fair	Fair
Cascara, *Rhamnus purshiana*	Leaves, berries	Yosemite, fall	Medium	Fair	Fair
Spiny myrtle, *Ceanothus spinosus*	Leaves, twigs	San Diego, winter	Medium	Fair	Fair
Pacific dogwood, *Cornus nuttallii*	Leaves	Sequoia, fall	Medium	Low	Slight
Madrono, *Arbutus menziesii*	Leaves	Yosemite, winter	Rare	Low	Slight
*Velvet elder, *Sambucus velutina*	Fruit, leaves, flowers	Yosemite, summer	Medium	Good	Great

NOTE.—Species followed by (?) are classed by Sudworth as trees although their normal growth in California is that of shrubs.
*Considered to be of outstanding importance as browse for mule deer in California.

TABLE II

SHRUBS OR BRUSH BROWSED BY VARIOUS RACES OF MULE DEER IN CALIFORNIA

Name	Parts eaten	Locality and chief seasonal use	Availability	Palatability	Relative importance
Mexican tea, *Ephedra californica*	Twigs	San Diego County, winter	Rare	Low	Slight
Longleaf willow, *Salix melanopsis*	Twigs	Sequoia, spring	Medium	Fair	Slight
Coyote willow, *Salix argophylla*	Leaves, twigs	Mono Lake, summer	Medium	Low	Slight
Silver willow, *Salix g. argentea*	Leaves, twigs	Sequoia, summer	Rare	Low	Slight
Mono willow, *Salix p. monica*	Twigs	Mono Lake, summer	Medium	Fair	Slight
Alpine willow, *Salix petrophila*	Twigs	Sequoia, summer	Rare	Low	Slight
Lemmon's willow, *Salix lemmoni*	Twigs	Yosemite, summer	Medium	Low	Slight
Sierra willow, *Salix commutata*	Leaves, twigs	Sequoia, summer	Rare	Low	Slight
California hazel, *Corylus r. californica*	Twigs, leaves	Yosemite, fall	Medium	Low	Slight
Quail brush, *Atriplex lentiformis*	Twigs	Colorado River, winter	Medium	Fair	Fair
Virgin's bower, *Clematis ligusticifolia*	Shoots	Sequoia, spring	Rare	Low	Slight
Spice bush, *Calycanthus occidentalis*	Twigs	Sequoia, spring	Medium	Low	Slight
Barberry, *Berberis californica*	Leaves	Yosemite, winter	Rare	Low	Slight
Golden currant, *Ribes aureum*	Berries, leaves	Lassen, fall	Medium	Fair	Fair
Currant, *Ribes viscosissimum*	Leaves	Yosemite, fall	Rare	Low	Slight
*Nevada currant, *Ribes nevadensis*	Berries, leaves	Lassen, fall	Common	Fair	Fair
Gooseberry, *Ribes velutinum*	Leaves	Mono Lake, summer	Rare	Low	Slight
*Gooseberry, *Ribes roezlii*	Leaves	Yosemite, fall	Common	Fair	Fair
Cream bush, *Holodiscus discolor*	Twigs	Mt. Whitney, fall	Common	Fair	Slight
Desert-sweet, *Chamaebatiaria millefolium*	Twigs	Mt. Whitney, summer	Medium	Low	Slight
*Thimble-berry, *Rubus parviflorus*	Leaves	Yosemite, summer	Medium	Good	Fair
Western raspberry, *Rubus leucodermis*	Leaves	Sequoia, fall	Medium	Low	Slight
Rose, *Rosa californica*	Leaves	Yosemite, summer	Medium	Fair	Fair
*Antelope brush, *Purshia tridentata*	Twigs, leaves	Lassen, winter	Common	Excellent	Great
Poison oak, *Rhus diversiloba*	Leaves	Yosemite, fall	Common	Low	Slight
Squaw bush, *Rhus trilobata*	Leaves	San Diego, fall	Rare	Low	Slight
Deer brush, *Ceanothus diversifolius*	Twigs, leaves	Lassen, fall	Medium	Fair	Fair
Tobacco brush, *Ceanothus velutinus*	Twigs, leaves	Lassen, fall	Common	Fair	Fair

Sweet birch, *Ceanothus parvifolius*	Twigs, leaves	Yosemite, fall	Medium	Good	Fair
*Deer brush, *Ceanothus integerrimus*	Twigs, leaves	Yosemite, fall	Common	Excellent	Great
*Deer brush, *Ceanothus divaricatus*	Twigs, leaves	San Diego, winter	Common	Excellent	Great
Deer brush, *Ceanothus tomentosus*	Twigs, leaves	Stanislaus, winter	Rare	Good	Slight
*Snow-brush, *Ceanothus cordulatus*	Twigs, leaves	Yosemite, Lassen, fall	Common	Good	Great
*Buck-brush, *Ceanothus cuneatus*	Twigs, leaves	Yosemite, Sequoia, winter	Common	Good	Great
Deer brush, *Ceanothus rigidus fresnensis* (var)	Leaves	Sequoia, fall	Medium	Good	Fair
Mahala mat, *Ceanothus prostratus*	Twigs, leaves	Lassen, winter	Medium	Good	Fair
Deer brush, *Ceanothus crassifolius*	Leaves	San Diego, winter	Common	Good	Fair
Flannel bush, *Fremontia californica*	Leaves	Sequoia, spring	Medium	Low	Slight
Buffalo berry, *Shepherdia argentea*	Leaves	Mt. Pinos, fall	Rare	Low	Slight
Silk tassel, *Garrya veatchii*	Leaves	San Diego, winter	Medium	Low	Slight
*Creek dogwood, *Cornus californica*	Twigs, leaves	Yosemite, Sequoia, all seasons	Common	Good	Great
Great-berried manzanita, *Arctostaphylos glauca*	Leaves	San Diego, winter	Common	Fair	Fair
Mariposa manzanita, *Arctostaphylos mariposa*	Leaves	Yosemite, winter	Medium	Fair	Slight
*Green manzanita, *Arctostaphylos patula*	Leaves	Yosemite, winter, spring	Common	Good	Great
Pine-mat manzanita, *Arctostaphylos nevadensis*	Leaves	Yosemite, fall, spring	Medium	Fair	Fair
Eastwood manzanita, *Arctostaphylos glandulosa*	Leaves	San Diego, winter	Medium	Fair	Slight
Manzanita, *Arctostaphylos drupacea*	Leaves	San Diego, winter	Medium	Fair	Fair
Yerba santa, *Eriodictyon californicum*	Shoots, leaves	Yosemite, summer	Medium	Fair	Fair
Snow berry, *Symphoricarpos albus*	Shoots, leaves	Yosemite, fall	Medium	Low	Slight
Chaparral honeysuckle, *Lonicera interrupta*	Shoots, leaves	Sequoia, summer	Medium	Low	Slight
Common sagebrush, *Artemisia tridentata*	Twigs, leaves	Modoc, winter	Common	Low	Fair
Black sagebrush, *Artemisia arbuscula*	Twigs, leaves	Modoc, winter	Medium	Low	Slight
Sagebrush, *Artemisia norvegica*	Leaves	San Diego, winter	Medium	Low	Slight

TABLE III

HERBS EATEN BY VARIOUS RACES OF MULE DEER IN CALIFORNIA

Name	Parts eaten	Locality and chief seasonal use	Availability	Palatability	Relative importance
Corn lily, *Veratrum californicum*	Leaves	Sequoia, fall	Common	Low	Slight
Yellow mariposa, *Calochortus luteus*	Flowers	Yosemite, spring	Common	Fair	Slight
Sego lily, *Calochortus nuttallii*	Flowers	Mono Lake, summer	Medium	Fair	Slight
Knotweed,[1] *Polygonum bistortoides*	Leaves	Yosemite, summer	Rare	Low	Slight
Lady's thumb,[1] *Polygonum persicaria*	Leaves	Yosemite, summer	Rare	Fair	Slight
*Yard grass,[1] *Polygonum aviculare*	Tips of stems	Yosemite, summer	Medium	Excellent	Great
*Curly dock,[1] *Rumex crispus*	Stalks, leaves	Yosemite, summer	Common	Good	Great
Sheep sorrel,[1] *Rumex acetosella*	Leaves	Yosemite, summer	Common	Good	Fair
Desert trumpet, *Eriogonum inflatum*	Stems	Chocolate Mts., fall	Common	Fair	Fair
Buckwheat, *Eriogonum thurberi*	Stem tips	San Diego, fall	Medium	Low	Slight
*(Tall) buckwheat, *Eriogonum nudum*	Tips, flowers	Yosemite, summer	Common	Excellent	Great
(Wire) buckwheat, *Eriogonum virgatum*	Flowers, stems	Yosemite, summer	Common	Fair	Fair
White pigweed,[1] *Chenopodium album*	Leaves	Yosemite, summer	Medium	Fair	Slight
Tumble-weed,[1] *Amaranthus graecizans*	Stems	Yosemite, summer	Common	Good	Fair
Common purslane,[1] *Portulaca oleracea*	Stems	Yosemite, summer	Rare	Fair	Slight
Columbine, *Aquilegia truncata*	Stems, leaves	Sequoia, summer	Common	Low	Slight
Columbine, *Aquilegia pubescens*	Stem tips	Yosemite, summer	Rare	Low	Slight
Western buttercup, *Ranunculus occidentalis*	Leaves	Yosemite, summer	Medium	Low	Slight
Flix-weed,[1] *Sisymbrium incisum*	Stem tips	Yosemite, summer	Medium	Fair	Slight
*Common yellow mustard,[1] *Brassica campestris*	Leaves, stems	Yosemite, summer	Common	Good	Fair
Black mustard,[1] *Brassica nigra*	Leaves	Yosemite, summer	Medium	Low	Slight
Rock cress, *Arabis cognata*	Leaves	Yosemite, summer	Rare	Low	Slight
Western wall flower, *Erysimum asperum*	Leaves, stems	Yosemite, summer	Common	Fair	Fair
Alum root, *Heuchera micrantha*	Leaves, stems	Yosemite, fall	Medium	Good	Fair

Five finger, *Potentilla g. nevadensis*	Stems, buds	Yosemite, summer	Medium	Low	Slight
Five finger, *Potentilla campestris*	Stems	Sequoia, summer	Medium	Low	Slight
Lupine, *Lupinus bicolor*	Leaves	Stanislaus, spring	Rare	Low	Slight
Lupine, *Lupinus concinnus*	Leaves	San Diego, spring	Rare	Low	Slight
Lupine, *Lupinus latifolius*	Leaves	Yosemite, fall	Rare	Low	Slight
*Bur clover, *Medicago hispida*	Leaves, burs	Yosemite, spring	Common	Good	Fair
Medick, *Medicago apiculata*	Leaves, stems	Stanislaus, spring	Rare	Fair	Slight
Black medick, *Medicago lupulina*	Leaves	Yosemite, spring	Rare	Fair	Slight
Sweet clover, *Melilotus alba*	Leaves, stems	Yosemite, spring	Rare	Fair	Slight
Sweet clover, *Melilotus indica*	Leaves, stems	Yosemite, spring	Rare	Fair	Slight
Creek clover, *Trifolium obtusiflorum*	Leaves	Stanislaus, spring	Medium	Low	Slight
Cow clover, *Trifolium involucratum*	Leaves	Yosemite, summer	Medium	Fair	Fair
Carpet clover, *Trifolium monanthum*	Leaves	Yosemite, summer	Rare	Fair	Slight
Tree clover, *Trifolium ciliatum*	Leaves	Stanislaus, spring	Medium	Fair	Fair
White clover, *Trifolium repens*	Leaves	Yosemite, summer	Medium	Good	Fair
Clover, *Trifolium lemmonii*	Leaves	Mono Lake, summer	Rare	Fair	Slight
Red clover, *Trifolium pratense*	Leaves	Yosemite, summer	Rare	Good	Fair
Deervetch, *Lotus micranthus*	Leaves, stems	Sequoia, spring	Medium	Fair	Fair
Deervetch, *Lotus subpinnatus*	Leaves, stems	Yosemite, summer	Medium	Good	Fair
*Spanish clover, *Lotus americanus*	Leaves, stems	Yosemite, summer	Common	Excellent	Great
American vetch, *Vicia americana*	Leaves	Yosemite, summer	Medium	Good	Fair
Campo pea, *Lathyrus splendens*	Leaves, flowers	San Diego, spring	Common	Good	Fair
White-stem filaree, *Erodium moschatum*	Leaves, stems	Yosemite, winter	Common	Good	Fair
*Filaree, *Erodium botrys*	Leaves, stems	Stanislaus, winter	Common	Good	Fair
Red-stem filaree, *Erodium circutarium*	Leaves, stems	Sequoia, winter	Common	Fair	Fair
Godetia, *Godetia dudleyana*	Tips	Yosemite, summer	Common	Fair	Slight
*Evening primrose, *Oenothera hookeri*	Leaves, tips	Yosemite, summer	Medium	Good	Great
Fire-weed, *Epilobium latifolium*	Leaves, tips	Mono Lake, summer	Medium	Fair	Fair
Squaw-root, *Carum gairdneri*	Flowers	Sequoia, fall	Common	Fair	Fair
Lacewced, *Gayophytum ramosissimum*	Flowers	Yosemite, summer	Common	Low	Slight
Cow parsnip, *Heracleum lanatum*	Dead leaves	Yosemite, fall	Common	Low	Slight
Mountain hemp, *Apocynum androsaemifolium*	Leaves	Yosemite, summer	Medium	Low	Slight
Indian hemp, *Apocynum cannabinum*	Leaves	Yosemite, summer	Medium	Low	Slight
Milkweed,[1] *Asclepias cordifolia*	Dead leaves	Yosemite, fall	Medium	Fair	Fair
Squaw lettuce, *Hydrophyllum occidentale*	Leaves	Sequoia, summer	Rare	Low	Slight
Blue curls,[1] *Trichostema oblongum*	Leaves	Yosemite, summer	Rare	Low	Slight
Horse mint, *Agastache urticifolia*	Stem tips	Yosemite, fall	Medium	Low	Slight
Hedge nettle, *Stachys albens*	Tips	Yosemite, summer	Medium	Low	Slight

Name	Parts eaten	Locality and chief seasonal use	Availability	Palatability	Relative importance
Nightshade,[1] *Solanum villosum*	Leaves	Yosemite, summer	Rare	Low	Slight
Monkey-flower, *Mimulus nanus*	Stems	Yosemite, spring	Rare	Low	Slight
Monkey-flower, *Mimulus mephiticus*	Shoots	Yosemite, summer	Medium	Low	Slight
Yellow monkey-flower, *Mimulus moschatus*	Stems	Yosemite, summer	Medium	Fair	Slight
Common monkey-flower, *Mimulus guttatus*	Leaves	Yosemite, summer	Common	Fair	Fair
Indian paint brush, *Castilleia parviflora*	Leaves, flowers	Lassen, summer	Rare	Low	Slight
Scarlet cup, *Castilleia affinis*	Leaves, flowers	Yosemite, summer	Rare	Low	Slight
English plantain,[1] *Plantago lanceolata*	Leaves	Yosemite, summer	Medium	Fair	Fair
False dandelion, *Agoseris grandiflora*	Leaves, stalks	Yosemite, summer	Common	Good	Fair
Bigelow sneezeweed,[1] *Helenium bigelovii*	Leaves, tips	Yosemite, summer	Common	Low	Slight
Western golden rod, *Solidago occidentalis*	Leaves, tips	Yosemite, fall	Common	Fair	Fair
Common golden rod, *Solidago californica*	Leaves, tips	Yosemite, fall	Common	Low	Slight
Yarrow, *Achillea millefolium*	Green tips	Yosemite summer	Medium	Low	Slight
Lessingia, *Lessingia leptoclada*	Stems	Yosemite, fall	Medium	Fair	Fair
California mugwort,[1] *Artemisia v. heterophylla*	Leaves	Yosemite, fall	Common	Good	Fair
Dragon sagewort,[1] *Artemisia dracunculus*	Leaves	San Diego, fall	Medium	Low	Slight
Senecio, *Senecio triangularis*	Stems	Sequoia, fall	Medium	Low	Slight
Senecio, *Senecio lugens*	Stems, tips	Yosemite, fall	Medium	Low	Slight
Horseweed,[1] *Erigeron canadensis*	Stem tips	Yosemite, fall	Common	Fair	Fair

[1] Sometimes considered as weeds in the agricultural sense.

TABLE IV

GRASSES AND SEDGES EATEN BY VARIOUS RACES OF MULE DEER IN CALIFORNIA

Name	Parts eaten	Locality and chief seasonal use	Availability	Palatability	Relative importance
Red brome, *Bromus rubens*	Sprouting blades	Stanislaus, spring	Rare	Low	Slight
Ripgut grass, *Bromus rigidus*	Tender blades	Yosemite, winter, spring	Common	Fair	Fair
Soft cheat, *Bromus hordeaceus*	Tender blades	Yosemite, winter, spring	Common	Fair	Fair
Brome grass, *Bromus arenarius*	Tender blades	Stanislaus, spring	Rare	Low	Slight
Fescue, *Festuca pacifica*	Blades	Stanislaus, summer	Medium	Fair	Fair
Fescue, *Festuca confusa*	Blades	Stanislaus, summer	Medium	Fair	Fair
Fescue, *Festuca grayi*	Blades	Yosemite, summer	Rare	Fair	Slight
*Meadow fescue, *Festuca elatior*	Blades	Yosemite, all seasons	Common	Excellent	Great
*Kentucky blue grass, *Poa pratensis*	Blades	Yosemite, summer	Medium	Good	Fair
Slender wheat grass, *Agropyron tenerum*	Blades	Yosemite, spring	Rare	Fair	Slight
Western rye grass, *Elymus glaucus*	Blades	Yosemite, spring	Medium	Low	Slight
Squirrel-tail barley,[1] *Hordeum jubatum*	Tender blades	Yosemite, winter, spring	Common	Low	Slight
*Wild oat, *Avena fatua*	Tender blades	Yosemite, winter, spring	Common	Good	Fair
Mountain timothy, *Phleum alpinum*	Blades	Yosemite, summer	Rare	Fair	Slight
Velvet grass, *Notholcus lanatus*	Blades	Yosemite, summer	Medium	Fair	Fair
Sedge, *Hemicarpha occidentalis*	Stalks	Yosemite, fall	Rare	Low	Slight
Saw-grass, *Cladium mariscus*	Green stems	Yosemite, spring	Medium	Low	Slight
Foothill sedge, *Carex tumulicola*	Stems	Stanislaus, fall	Medium	Fair	Fair
Western sedge, *Carex feta*	Dead stems	Sequoia, winter	Medium	Good	Fair
Soft sedge, *Carex disperma*	Stems	Mono Lake, summer	Medium	Low	Slight
Sedge, *Carex yosemitana*	Stems	Yosemite, fall	Medium	Fair	Fair
Sedge, *Juncus mertensianus*	Stems	Yosemite, fall	Rare	Low	Slight

[1] Often regarded as an agricultural weed.

TABLE V

MISCELLANEOUS FOODS EATEN BY VARIOUS RACES OF MULE DEER IN CALIFORNIA

Name	Parts eaten	Locality and chief seasonal use	Availability	Palatability	Relative importance
Cotton fern, *Notholaena newberryi*	Fronds	San Diego, winter	Medium	Low	Slight
Bracken, *Pteris aquilina*	Fronds, young tips	Yosemite, summer	Common	Fair	Fair
Coffee fern, *Pellaea andromedaefolia*	Frond tips	San Diego, winter	Medium	Low	Slight
Grasshopper	Whole insect	Yosemite, summer	Medium	Fair	Slight
Mistletoe, *Phoradendron* (sp?)	Branches	Yosemite, winter	Medium	Fair	Fair
Fungi, Scaly lentinus, *Lentinus lepidens*	Crown and stalk	Yosemite, summer	Medium	Good	Fair
Fungi, *Clavaria formosa*	Crown	Lassen, summer	Rare	Good	Slight

FOURTH ANNUAL BLACK BRANT CENSUS IN CALIFORNIA

By JAMES MOFFITT

The fourth annual census of black brant, *Branta bernicla nigricans*, was made in California February 10 to 12, inclusive, 1934. Results of the three previous censuses have been reported upon by the writer in CALIFORNIA FISH AND GAME as follows: vol. 17, 1931, pp. 396–401; vol. 18, 1932, pp. 298–310; vol. 19, 1933, pp. 255–263.

The 1934 census was, in many respects, the most satisfactory one made to date. The cooperators felt that the counts that they made in California this year were the most accurate ones secured during this work. This year, for the first time since this work was undertaken, other states interested themselves in it and censuses were made in Oregon and Washington coincident with ours. The results of these counts are recorded in this paper and serve to provide a much more intelligible idea of the entire Pacific Coast brant population than could California censuses alone portray.

The census of black brant on Mission and San Diego bays was made by Game Warden E. H. Glidden, assisted by Clinton G. Abbott, Director of the San Diego Natural History Museum, and A. Muelheisen of that city on February 10, 1934. Most of the day was devoted to taking the census, the greater part being spent on Mission Bay. Tides for the day in San Diego Bay were as follows: high tide, 5.56 a.m., 6.1 feet; low tide, 1.30 p.m., –1.0 feet. The tides on Mission Bay were one and one-half hours later. This party recorded 154 brant on Mission Bay and seven birds were seen on San Diego Bay on the mud flat on the east side northwest of the old cotton seed plant. The total number of brant observed in this region therefore was 161 birds.

The writer took the census on Morro Bay the same day where he was assisted by Game Warden F. W. Hecker and Dr. A. P. Marshall, of San Luis Obispo. The count was commenced at 7.40 a.m. and completed at 10.10 a.m. and was made from an outboard motorboat. The day was clear and calm and the excellent weather materially assisted in permitting us to secure what we all agreed was a very accurate record of the number of brant present on Morro Bay that day, a total of 3895 individuals. The tides on Morro Bay February 10, 1934, were as follows: high tide, 7.24 a.m., 6.0 feet; low tide, 2.59 p.m., –1.3 feet. During the course of census taking, a close watch was kept for brant flying between the Bay and the ocean but as no bird was seen to do so we concluded that all the brant of the immediate vicinity were in the Bay as inspection of the calm ocean from the sand dunes on the beach failed to reveal a brant on its glassy surface. However, there may have been some brant on the coast that day a few miles to the northward as Game Warden Hecker and fishermen told of numbers that they had seen feeding in the kelp on the ocean off Cayucos a few days previous. According to fishermen and local residents, it is an annual custom for the brant to feed in the ocean in this vicinity, a few miles northward from

Morro Bay, at this season, but they do not resort to this coast before early February so whatever feed it is that draws them there is probably not available or suitable before that time. We regretted very much our inability, on account of lack of time, to visit this part of the coast that day to count the birds. This should be done in taking future brant censuses in the region when it would be highly desirable to ascertain what factor is responsible for the birds' presence there.

Censuses were made in 1934 at the same time on Drakes, Tomales and Bodega bays in order to eliminate the possibility of birds shifting from one to another of these neighboring bodies of water which fact suggested itself in 1933 when the census on Tomales Bay was taken two days later than were the counts on Drakes and Bodega bays.

T. T. McCabe, Berkeley, California, again took the census on Drakes Bay, this being the third year in which he has counted the brant there on February 11. This year he was assisted by J. E. Cushing, Jr., San Francisco. The tides on Drakes Estero (for map see CALIFORNIA FISH AND GAME, vol. 18, 1932, p. 302) were approximately the same as those listed in the following paragraph for Tomales Bay. The census was taken from 9 a.m. to 1.45 p.m. during which period a strong southwest wind was blowing causing whitecaps to form on the Estero and the birds to be restless. This condition rendered making an exact count impossible, but the cooperators felt that they secured a reasonably accurate census notwithstanding. No count was attempted on Estero de Limantour and the results obtained apply solely to Drakes Estero where a total of 2189 brant was noted by the census takers.

The writer's attempt to count the brant on Tomales Bay the morning of February 11, 1934, from an outboard motorboat was frustrated by a balky motor so an estimate of the birds' numbers was made from shore from seven to ten o'clock. This count netted 5238 brant, but was feared to be low because the wind that hindered McCabe's and Cushing's work on Drakes Bay was also blowing on Tomales Bay where it made accurate counting difficult and working from shore by necessity made it hard to count brant on the opposite (westerly) shore, where, fortunately however, no birds were seen with the glasses. About 2 p.m the southwest wind that had been blowing strongly all morning, suddenly ceased and the brant all congregated in large flocks in smooth water between Hamlet and Toms Point on the eastern shore of the Bay where they were easy to count accurately from shore (see map, CALIFORNIA FISH AND GAME, vol. 18, 1932, p. 301). Here 5565 individuals were recorded between 2.45 and 4 p.m., which number was thought to represent more accurately the total number of brant present on Tomales Bay that day than did the morning's count and is therefore accepted as the figure for the 1934 census. The tides on Tomales Bay on February 11, 1934, were as follows: high tide, 8.36 a.m., 6.4 feet; low tide, 3.51 p.m., –1.2 feet. The day was clear with wind and calm as above noted.

Dr. Jean Linsdale, assisted by W. H. Behle, Berkeley, took the 1934 census on Bodega Bay on February 11 (Linsdale took the 1932 and 1933 censuses at the same point on the same date). In commenting upon the 1934 census Linsdale stated: "In spite of the strong wind, we made a fairly satisfactory count, beginning at 8.45 a.m. The locations of the birds and the point from which they were counted were much the same as for last year. * * * By noon, the brant had con-

gregated in bunches, much as last year, but there were more people on the Bay in boats this time and the birds moved about too much to satisfactorily map their locations." (For map of Bodega Bay showing location of black brant on February 11, 1933, see CALIFORNIA FISH AND GAME, vol. 19, 1933, p. 256.) Linsdale and Behle counted a total of 1298 brant on Bodega Bay this year. The tides here were similar to those listed above for Tomales Bay.

Captain of Game Wardens W. J. Harp and the writer counted the brant on Humboldt Bay on February 12, 1934. The weather was clear and calm that day with the following tides: high tide, 10.01 a.m., 7.2 feet; low tide, 5.15 p.m., –1.2 feet. We devoted the morning, commencing at 9.30 a.m. to census taking on South Bay, where, working from outboard motorboat we secured a very satisfactory count totalling 10,860 brant. In the afternoon we circled North Bay by automobile, stopping and scanning its placid waters with glasses from every vantage point and concluded that 6000 brant fairly represented the number of birds present there that afternoon. Thus the total census for Humboldt Bay was 16,860 brant.

J. B. Phillips, Bureau of Commercial Fisheries, who is located at the Hopkins Marine Station, Pacific Grove, kindly advised that he noted approximately 400 black brant on the Pacific Ocean off the Station on February 11, 1934. This is an unusual number of birds for this locality, where the species is usually noted only in migration and these brant seen by Phillips were doubtless moving along the coast between two of our larger bays favored with growths of eel grass and frequented by this species.

Recapitulation of the 1931, 1932, 1933 and 1934 Black Brant Censuses

Locality	*1931*	*1932*	*1933*	*1934*
Humboldt Bay	Unsatisfactory	29,415	5,000	16,860
Bodega Bay	None made	3,200	977	1,298
Tomales Bay	9,445	6,285	7,409	5,565
Drakes Bay	None made	2,108	318	2,189
Morro Bay	4,493	2,938	None made	3,895
Mission Bay	71	No birds	115	154
San Diego Bay	No birds	No birds	No birds	7

1933 FALL BRANT MIGRATION IN CALIFORNIA

The fall migration of black brant in California in 1933 seems to have been the earliest one on record since observations have been especially sought by me during the past ten years, or perhaps the interest in this matter that my queries have instilled into various persons has resulted in a more careful watch being kept for these birds, resulting in earlier records. At any rate, numbers of brant were seen on Tomales Bay and in the ocean off Tomales Point during the last two weeks of October, 1933. H. J. Jensen who resides at Hamlet on Tomales Bay told me on November first last that several hundred brant stopped in the bay for a day or two on or about October 25 and that a few individuals were noted there on October 19 and every day following. Mr. H. C. Conrad, San Francisco, told me that he went fishing in the Pacific Ocean off Tomales Bay on October 14 where he saw flocks of brant averaging 50 birds each that totaled 300 individuals. I was gunning for ducks on Tomales Bay on November 1, 1933, when I saw a flock consisting of 16 brant fly into the bay from the ocean about midday. I was unable to revisit Tomales Bay last fall until

December 16 by which date brant were very numerous there. At that time, Jensen and others told me that the birds had become sufficiently abundant by mid-November to afford fair sport, whereas they usually do not appear in such numbers on this bay until Thanksgiving or later.

Captain of Game Wardens W. J. Harp, Arcata, wrote me on January 6, 1934, stating that brant shooting during the 1933 waterfowl hunting season had been very successful. The birds put in their appearance on Humboldt Bay far earlier in 1933 than in the previous year. Harp stated that small flocks commenced to arrive about December 1, 1933, and that the species was sufficiently common after December 15 to afford good sport to hunters for the remainder of the season (until December 31). Harp estimated that there were 10,000 brant present on Humboldt Bay during that period. The previous season (1932) brant were so late in reaching Humboldt Bay that few were shot before the season closed on December 31 and the birds had not arrived there in numbers by February 12, 1933 (see CALIFORNIA FISH AND GAME, Vol. 19, 1933, pp. 258–259).

At the time of my visit to Morro Bay, February 10, 1934, Game Warden Hecker and A. C. Silva stated that brant became common on its waters exceptionally early in the preceding fall and that good shooting was had from mid-November until the close of the gunning season.

An unusually late date for brant to tarry in our waters in the spring was provided by S. H. Dado of this Division who noted a flock of 12 or 13 individuals in the ocean off New Years Island, San Mateo County, on May 29, 1934.

BRANT CENSUS IN OREGON, WASHINGTON AND BRITISH COLUMBIA

Through the kind offices of Dr. I. N. Gabrielson, Bureau of Biological Survey, U. S. Department of Agriculture, I was successful in interesting the Oregon State Game Commission into cooperating with our brant census work to the extent of directing its game wardens stationed along the Oregon coast to count the brant present there February 10–12, 1934. Results of these observations were kindly provided by State Game Supervisor F. B. Wire in letter dated February 26, 1934, as follows:

> We have received copies of officers' reports concerning black or sea brant observed in Lincoln and Tillamook counties as follows:
>
> John H. Price, State Police, Newport:
>
> "On February 12th, observed about 100 black or sea brant in this vicinity as follows: Yaquina Bay about 80, Siletz Bay 20. There have been large flocks of sea brant on Yaquina Bay for some time."
>
> Earl C. Williams, State Police, Tillamook:
>
> "With reference to letter from Mr. Wire rel. observing number of black brant or sea brant between the dates Feb. 10th and 12th, did not get a chance to personally observe for the two days mentioned, but on inquiry, there seemed to be more in Netarts Bay than anywhere else. I observed some two or three thousand in bay and am told that a large number migrated on north from the bay about two or three days ago."

My inquiries to the Washington State Department of Game in the fall of 1933 relative to the numbers of black brant frequenting the waters of that State met with hearty and cordial response from Director

of Game Lou Ovenden. As a result this gentleman delegated Arthur S. Einarsen, then of the Department, to gather all possible information on the subject during the season and to transmit same to me. During the fall hunting season, Einarsen devoted much time to this detail and prepared a masterly report on the subject under date of December 18, 1933, which he forwarded to the writer with permission to use in whole or in part in connection with the present paper. We are therefore greatly pleased and highly obligated to the Washington Department of Game to quote from Einarsen's report as follows:

Black brant (*Branta bernicla nigricans*) are found in varying abundance within the territorial limits of the State of Washington during the different seasons of the year.

With the opening of the shooting season, on October 16, 1933, very few reports were made of black brant being seen on the opening day, although many snow geese (*Chen hyperboreus*), a few Canadian honkers (*Branta canadensis*), and also a scattering of whistling swan (*Cygnus columbianus*), were seen on the opening day. On the Skagit Flats three geese were shot—one a snow goose, and the other two Canadian geese. Following through the season there were no reports of an abundance of brant until about November 1st, when visitors to the ocean coast, between Grays Harbor and the Columbia River, reported them in considerable numbers, feeding along the coast line. As excellent hunting can be enjoyed in both Grays and Willapa harbors as soon as the black brant enter these areas to feed, their actions were closely watched, and very few entered the bays until about Thanksgiving time when the majority of the birds still favored the open ocean along the coast. It was not possible for me to make personal observation of their numbers and actions but through the word of hunters there seems to be little doubt that such conditions existed.

In the northern portion of the State brant can be expected to congregate, chiefly in the following areas: The Gulf of Georgia, near Point Roberts and Blaine, Bellingham Bay, Samish Bay, Padilla Bay, Bellingham Channel, Rosario Straits, the Straits of Juan de Fuca, Livingston Bay and Hood Canal.

A continual contact maintained with the shooting fraternity, gave little encouragement until about November 15th, when a few birds were reported from the Livingston Bay area, and with scattered reports of increasing numbers in Bellingham Bay, where about November 23d, a few birds were taken. On December 2d and 3d a hasty trip along Hood Canal and the Straits of Juan de Fuca, in the Dungeness and Protection Island districts revealed very few birds. Normally these areas are highly favored, but on these dates the annual winter residents had not arrived to a noticeable degree. Communicating with boatmen employed on regular runs through the districts where brant might be expected to appear, it was generally reported that no great numbers were apparent until about December 1st, and up to date have been increasing with rapid strides.

Going into the field in the northern district on Puget Sound, on December 12th, the Blaine area on the Gulf of Georgia produced fair numbers of birds. As there is considerable high ground to the south of Blaine, overlooking the Gulf of Georgia, by means of field glasses, approximately 30 small flocks, ranging in numbers from 10 to 100, could be seen feeding on the Gulf. These waters are not hunted to any degree, and as there are a few sand spits on the Lummi Indian Reservation, which are not open to shooting by the general public, they are favorite resting areas for the brant.

On December 13th Padilla Bay and Samish Bay claimed my attention, and these areas were found to be occupied by brant in such numbers that plans were made to follow them closely on the following day. In glancing at the attached sketch [see map, Fig. 136] maybe it will be noticed that there is an abundance of open water and that eel grass flats abound in the district, and later investigation of the crops of five brant dissected revealed the presence of nothing but eel-grass in their diet. The more limited area lies to the south in the Padilla Bay district, and it was found that there is a definite daily migration, beginning at daylight in the morning, from the northern areas when hundreds of flocks fly into Padilla Bay, almost touching

land, as far south as the entrance to Swinomish Slough. This definite daily migration continues until about noon. As this was the approximate time of high water, it leaves a little doubt in my mind as to whether the tide stage influenced their actions or whether this was a normal daily occurrence. I had not the opportunity to establish this point, but the fact remains that the southerly migration on both the 13th and 14th terminated about that time. There was little activity until evening, with the first of the flight northward beginning about 4 p.m., and until long after dark, the flight continued. It was my assumption that the northerly flight is for the purpose of reaching more open and unrestricted waters where the brant may drift and rest at night without being cast upon the shore as there are heavy currents in these

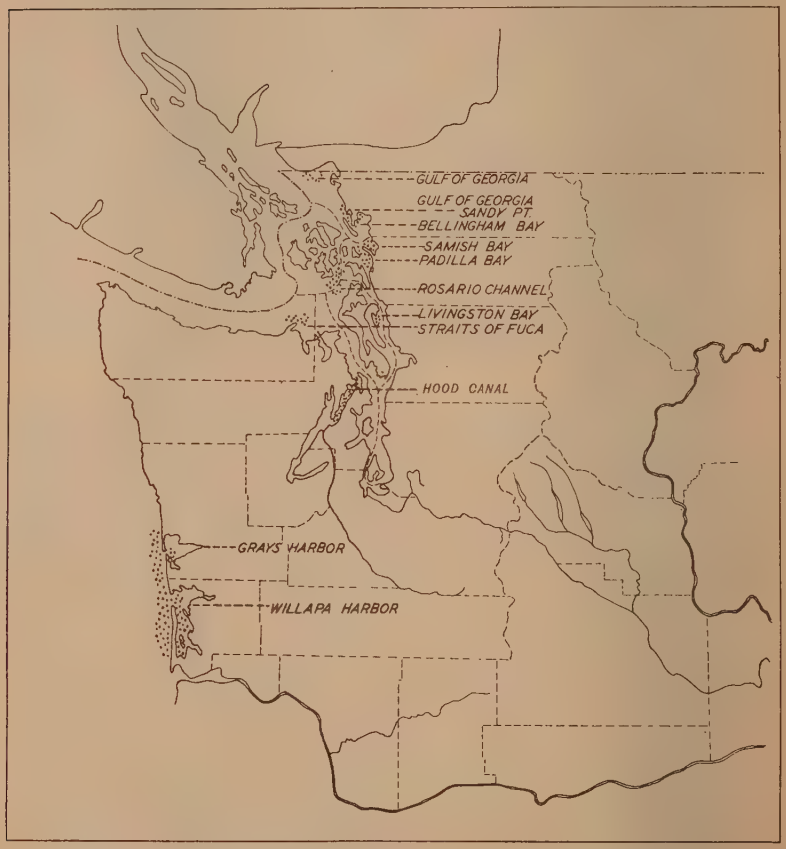

FIG. 136. Map showing brant concentration areas, State of Washington.

bays, which in conjunction with the storms that were persisting, could be expected to drift them onto the beaches in a short while. Even in Samish Bay they must be continually alert to keep off shore as with the heavy winds they drift quite rapidly.

Observing birds at close range on December 14th, it was found that they could breast a fifty-mile gale with ease, both in the air and on the water. At one spot, with a four-knot tide running, with seas approximately 12 feet high, a small group of about twenty birds remained practically stationary for an hour's time, but, of course, were continually alert to retain their position.

Outside of the gony (albatross) there is no bird to my knowledge that pays as little attention to the storm tossed waters as the black brant. On the 14th of December the sea was comparatively calm, with thousands of brants winging their way to the south and coming to rest in Padilla Bay, near Hat and Saddle-Bag Islands. The wind gradually increased so that at noon it had reached a velocity of approximately 50 miles, but this terrific wind did not cause them any inconvenience or develop a flight of birds, and all brant that were seen in the air were still approaching from a northerly direction, boring southward at a terrific rate, and coming to rest in apparent satisfaction among the flocks already feeding in Padilla Bay. At the same time a flock of approximately 50 snow geese were seen upon the horizon to the north, a distance of approximately six miles, but these birds were in sight for twenty minutes, weaving back and forth against the wind, and continually changing their elevation, depending upon the gusts of wind, and finally disappearing to the south, skimming the waves. Brant in a similar situation flew as straight as an arrow with a uniform speed that would take them out of sight in about five minutes. A rough count of the birds seen on the 14th, passing Point Williams on Samish Island, places the figure at 7900. Only the southward bound birds were counted and there could be little possibility of duplication, since during that period less than fifty birds passed Point Williams, drifting northward.

Hunters who periodically visited these grounds during the past season, report that the migration reached the area only about the fifth of December, and very few birds were taken until December 10th, when the daily kill in the district would sometimes amount to fifty birds. They are not generally sought after, except by a few limited hunters, who were properly equipped. On December 13th, several bags were investigated, an aggregate of fourteen birds scrutinized. They were all of the species of *Branta bernicla nigricans*,* and with few exceptions were in prime condition.

Generally speaking, it is the consensus of opinion amongst the gunners who seek brant, that the present season is much too early to give them good brant hunting, as the migration reaches this State on its sheltered waters only a short period before the season closes [December 15]. The thought arises that if this season is maintained generally through the west coast, it may contribute a great deal to the maintenance of the abundance of black brant since they can not then be overshot and they are not poached upon in this State during the closed season, since any hunter preying upon them would be far more conspicuous than a poacher on ducks that enter the fields and other obscure places to meet their doom at the hands of a skulking poacher.

Plans are going forward to collaborate with the State of California, whose work is under the direction of James Moffitt, to take a general census on February 10th to 12th, and there is little doubt that a quite accurate count can be taken by the use of our field force at certain strategic spots. Fortunately the interest in brant is being developed before their value as a game bird is generally appreciated and remedial measures to perpetuate them, if inaugurated in the near future, will be easily enforced as very limited resentment of any type will need be combatted. * * * Field observations above recorded were made to ascertain to what extent the brant are being hunted, and it was found that the entire kill of brant this year throughout the State of Washington, probably was less than one thousand birds. The Puget Sound area alone shows records of about 470 birds killed, and, of course, there will be some not generally reported or known of. The southern portion of the State, along the coast, including Grays and Willapa harbors, have produced some birds, but their number is unknown, and I believe the above figures would be extremely liberal. It is doubtful if the returns requested of license holders will be even as accurate, as many of the brant hunters take out parties of gunners on the favorite grounds, and do not report their kill, as they feel the numbers which they should record to be extremely high and derogatory to their continued

* Dr. Joseph Grinnell, Director, University of California Museum of Vertebrate Zoology, advised me on June 15, 1934, that E. J. Booth, Bellingham, Washington, sent a brant to him to be identified which he shot on the Samish Flats, Skagit County, Washington, on December 10, 1933. Dr. Grinnell stated that this bird is possibly somewhat of an intergrade between *Branta bernicla nigricans* and *Branta hernicla hrota*, but that it is so far nearer the latter as properly to bear the name *hrota*, the Atlantic or light-bellied brant.—*James Moffitt.*

existence, as action to curtail this shooting might be attempted in the light of such information.

Due to the necessary expense, a complete coverage of the brant areas could not be made, but information will be assembled as far as possible to render a reasonable appraisal of existing conditions in all districts for the winter of 1933–34.

(Signed) ARTHUR S. EINARSEN.

Upon receipt of this report, I wrote Einarsen drawing his attention to the statement in the second paragraph of his report to the effect that brant were noted along the Washington ocean coast after November 1, but few entered the bays until the last of that month. I commented to him upon similar habits that I have noted in the past in this species along the California coast where we apparently have an early fall flight of brant, some of which appear off our shores in mid-October, but the birds do not enter our bays in numbers until after mid-November. One theory that I have in this regard is that these early south-bound birds are migrating to Lower California and they apparently do not stop except for brief rests along our coast. Another theory that I suggested to Einarsen might account for the habits of the Washington coast brant as well is that the spawning of our herring may be a factor in governing the time at which brant enter our bays. In preceding years I have noticed that the arrival of these birds on Tomales Bay has closely coincided with the first spawning of our herring (*Clupea pallasii*), further that the early spawning schools of herring deposit their eggs on isolated patches of eel grass in different parts of the bay, which are very noticeably the patches of eel grass first utilized by brant for food. The fact that the first appearance of numbers of brant on Tomales Bay in several different seasons has closely coincided with the commencement of herring spawning and the fact that the birds feed mainly where these fish have spawned, are responsible for my opinion in this regard.

In response to this suggestion, Einarsen kindly replied as follows, which seems to settle the question in this regard:

I can see that there, perhaps, are some points of difference in the habits of black brant in regard to their custom, in California, in foraging on eel-grass covered with herring spawn. From years of experience on the bays and inlets of Puget Sound, I have become acquainted with all of the herring spawning grounds, the majority of which are in shallow water where eel-grass abounds, although there are a few deep water spawning areas also. Peculiarly brant are not found on any of the spawning grounds, which is entirely at variance with the California situation. Our local herring (*Clupea pallasii*) begin spawning during the month of January and continue until about the middle of May. Many of these favored spots, to which they return to spawn year after year, are in the center of the brant waters, notably Hales Pass, a portion of Bellingham Bay, the Duckabush Flats, near Brinnon in the Hood Canal district, and Birch Bay, a short distance from the exceptionally heavy concentration of brant, near Sandy Point, Gulf of Georgia. As I have spent a great deal of time at all of these spawning grounds, I feel justified in making the statement that in Puget Sound I have never seen a solitary brant taking advantage of this abundant food, although I have fine pictorial records of thousands of other birds that congregate annually, during the herring spawning season, to solve their food problem. I shall devote more time during the present season to substantiate these statements.

At Director of Game Ovenden's request, Einarsen and other members of the Department conducted a brant census in Washington on

February 14, 1934. Einarsen wrote that this survey was quite successful although he imagined that certain districts which were missed would have swelled the total count, but that roughly there was an abundance of brant on that date and they were still particularly numerous in the Straits of Juan de Fuca near Dungeness. Due to the fact that Einarsen severed his connection with the Department the day following the census taking, no detailed and itemized report was prepared, but in his letter to me dated July 17, 1934, he wrote that there was considerable enlightenment in this survey for certain districts which had been considered as highly favored by brant produced very small numbers. This can be accounted for by the fact that the shooting season had closed and it was not necessary for them to be isolated into these districts but they could migrate into areas that during the open season would have been disastrous for them to occupy. The result of this census provided a total of approximately 30,000 birds for the State of Washington for that day, which it is interesting to compare with the grand totals for Oregon and California, respectively 3000 approximately and 29,986. It seems strange that the numbers for the State of Washington approximately equal our count for California for the former state is so favored with inlets and bays supporting growths of eel grass that seem to afford ideal feeding places for this species that I should think its waters could support far larger numbers than can our few suitable California bays.

I regret very much that pressure of other work preceding the 1934 brant census taking time prevented my contacting the British Columbia Game Department and friends residing along the coast of that Province relative to cooperating with our work to the extent of counting the brant in their respective localities on the dates designated. I did address Kenneth Racey, West Vancouver, British Columbia, in this regard and he was so kind as to take a census of the brant in this vicinity on February 10 and 11. On the first day, Mr. Racey visited Sea and Lulu islands where no brant were noted although a small flock had been reported there in November. The next day he noted a flock of from 50 to 60 birds in the Sound about a mile northwest of Crescent Beach. Stewart Loutit, an experienced hunter and a reliable observer, at Mr. Racey's request, kindly made observations on the brant present near Point Roberts on February 11, 1934, where he noted but 150 birds lying in flocks of from 30 to 40 each about a half mile off shore. Mr. Loutit stated that there had been about 1500 brant in this locality at the beginning of the hunting season and that most of these birds moved down towards Birch Bay on the American side of the international boundary and that only between four and five hundred individuals wintered about Point Roberts, Boundary and Mud bays. Racey wrote that there has been a great reduction in the number of brant in this locality during the past two years which he attributes principally to damage to their principal food, eel grass, by excessively high tides and the silting in of channels.

CONCLUSION

In conclusion I wish especially to acknowledge with sincere appreciation the assistance of those who cooperated with the 1934 census taking and without whose help this work would have been impossible.

I feel especially grateful to those who helped in outside states and provinces, for this brant census began as a California project of my conception and it is certainly not my intention to attempt to make it an annual affair all along the Pacific Coast. Last winter I had hopes of securing a rather accurate record of the total number of brant on the Pacific Coast north of the Mexican boundary at census taking time. That we were successful in this as far as the United States is concerned, seems assured, and I feel that had I been able to make more requests to Canadians for assistance, we should also have secured a fairly complete census for British Columbia as well.

I feel assured that a fifth annual brant census will be taken in California in February, 1935, for the cooperators all seem to be in sympathy with continuing this work. The dates will probably be the same as were originally selected, for even though February 10 to 12 now seems to be too early to secure maximum brant concentration in California (two or three weeks later would be better for this purpose) this factor, to me, is overweighed by the desirability of continuing our counts on the same dates, now that we have the records for four seasons.

I fully appreciate the importance and desirability of periodically, say every five years, taking stock as it were of all our Pacific Coast black brant by taking coincident censuses wherever the species is known to occur. In this way we could very definitely ascertain the trend of this species. However, it seems useless to consider such an undertaking and to again burden our indulgent northern neighbors with the request for another census until means are devised for counting the black brant wintering in Lower California where large numbers are known to resort. This problem presents real difficulties, for transportation by road is almost impossible along the central part of the peninsula where the birds are known to winter in large aggregations. To attempt to take the census by boat, would, I fear, be more expensive than the results would justify, so sea-plane, if the birds could be counted from one, appears to be the only practical solution. If it develops that it is practical to so count brant, I shall try to organize a party to do so and hereby solicit help from anyone interested in this enterprise. If this could be arranged, I would then advocate that a very careful count be also made at the same time all along the Pacific Coast to the northward as far as brant are known to winter and the accumulated results should provide a fair estimate of the total number of birds wintering on this side of the Pacific. Such information might become invaluable in the event, for instance, of an eel grass shortage on the Pacific Coast such as the one which has recently so seriously reduced the numbers of Atlantic brant.—*August 27, 1934.*

AN EXPERIMENT IN QUAIL IMPORTATION

By Gordon H. True, Jr.

When the Division of Fish and Game inaugurated its quail replenishment program in southern California early in 1932, the valley quail that were used for restocking were solely the product of the Los Serranos State Game Farm, at Chino. During the following season, the increase in the total acreage of available refuge lands warranted the purchase of birds from private breeders to supplement the production of the game farm. Over nine thousand quail were liberated during this 2-year period. It was then that the Commission conceived the idea of importing valley quail from the west coast of Lower California since, by so doing, the volume of birds available for restocking purposes might be immeasurably increased and the cost of the program to the sportsmen materially reduced. The author wishes to take this opportunity to present to the sportsmen an account of our operations in this direction, an experiment that will most certainly react in their favor.

Negotiations were officially set in motion during the month of September, 1933. Since the Division did not number among its personnel a man with a thorough understanding of the Mexican, his language and methods, the first step was to enlist the aid of such a personage. In San Ysidro, California, we found H. S. Weir, a man who possessed all the desired qualifications and who willingly consented to act in the capacity of official intermediary between the Division and the Mexican government. Preliminary negotiations consumed much of the fall of 1933 and it was not until the month of December that they had been completed and we were able to proceed. Time was then short, with the rainy season rapidly approaching, but the Division was none the less elated for it held in its hands written permission to import from Mexico a total of one hundred thousand quail. The Mexican government graciously consented to waive the export tariffs in the case of all birds destined for southern California refuges. On December 23, 1933, the first truck load of birds passed over the border.

The quail were secured by Mexican trappers, and brought to the border by truck where they were delivered to representatives of the Division at San Ysidro. According to a regulation of the Mexican Department of Agriculture, trapping activities were confined to territory south of the village of San Telmo, Lower California, situated at a distance of some two hundred miles below the border. Each shipment was inspected by a Mexican official resident at San Telmo, was sealed by him and taken to San Ysidro without further formality. It had been hoped that the Lower California birds could be liberated immediately upon their arrival on southern California soil, but, it was later deemed advisable to alter the original plan. The long, rough, dusty journey from San Telmo to the border resulted in a number being dead or in a dying condition upon arrival. Consequently, each shipment was taken to Chino and held at the game farm until the birds had recuperated from the effects of the rough handling they had received. After a

sufficient period of time had elapsed, the quail were sorted, banded with aluminum leg bands and liberated at various points throughout southern California.

It was to be expected that a certain percentage of loss would be incurred in handling a large number of birds, and anticipating the situation, it was stipulated that the trappers rather than the Division should assume responsibility for most of the loss. Consequently, proper deductions were made on payment. It was hoped that this arrangement would result in more careful handling of the birds on the part of the trappers and that a lower percentage of loss would follow.

We paid a visit to a quail trapper's camp in Lower California. It was late in the evening when we arrived at their bivouac. The darkness

FIG. 137. Typical Lower California quail cover near San Quintin. Photo by G. H. True, Jr.

allowed us to see but little of our immediate surroundings, but to the eastward we could make out the rugged peaks of the San Pedro Martir, against the sky outlined by a full moon. The trappers, or cordoniceros as they call themselves, were squatted about their fires preparing supper. On each fire was a blackened pot of coffee and an equally blackened pot of frijoles. At one fire, a young Mexican was busily engaged in transforming unhealthy looking lumps of dough into deliciously crisp tortillas. So interested were we in that particular phase of Mexican cookery that it was with a feeling of reluctance that we withdrew to a discreet distance, pitched our own camp and hastened to care, American fashion, for the needs of the inner man. As we attacked a rapidly vanishing mountain of ham and eggs, one Domingo produced a battered guitar and a hastily organized trio of young cordoniceros proceeded to fill the moonlit night with Spanish melody. Tired out, we soon sought our blankets while still forms about slowly dying fires told us that our Mexican hosts were likewise consigning themselves to the forgetfulness of repose.

We were up and about at dawn and hurriedly gulped down a hastily prepared breakfast, anxious to see all that was being done. Senor Jose Felix, the chief trapper, informed us, however, that we hurried needlessly, for the trappers wanted at least an hour's start ere we appeared upon the scene. They left camp as he spoke, in two battered, topless touring cars loaded down with rolls of wire and other quail trapper's accoutrements, and soon vanished to the eastward in a cloud of dust. While waiting for our hour of departure we had time to look about us and noted that we were in a wide valley that narrowed rapidly to the eastward as the low, rolling foothills of the San Pedro Martir encroached upon it. We were in a barren land, treeless and drab, but none the less magnificent because of those very qualities. Low shrubs of various species, few over 12 inches in height, comprised most of the vegetation. Here and there were interspersed clumps of cholla and, less frequently, the pithaya or organ pipe cactus. We were camped in a group of larger shrubs, similar in appearance to the creosote bush, and these, together with the ever-present mescal, or maguay, completed the picture that was spread before us.

As we sat there drinking in the scenery the time passed quickly and soon we were trudging eastward in the wake of Senor Felix, a tall, powerful man with an ornate buckskin overcoat and, best of all, a fair speaking acquaintance with the English language. As we journeyed up the valley we met with several coveys of quail, for it was still early and the birds were busy feeding. The several hundred birds that comprised each covey evidenced little alarm at our approach, merely moving out of our path and continuing their search for food. We also observed at various points large V's of piled brush and were told that these were the remains of quail traps that had been in use prior to our visit. This prompted Senor Jose to embark on a detailed account of quail trapping methods, but in the midst of his discourse he stopped short and raised his hand for silence. We ceased our chattering and in the dead silence that followed we heard a faint but incessant clicking noise coming from a point not far distant.

Quickening our pace we soon arrived at the source of the strange sound and saw before us five of the trappers advancing slowly across the floor of the valley in a semicircular skirmish line. Each of the boys held a stick or stone in either hand and by striking them rapidly together produced the clicking noise that had piqued our curiosity. As we drew still nearer we could see that the line of trappers partially surrounded a large covey of quail that was being slowly driven toward the mouth of a brush V, similar to those we had observed on our walk from the encampment. As the covey approached the trap, the pace of the drivers became perceptibly slower though still accompanied by that incessant clicking. The birds gradually entered the V, milled about for a few moments and then flushed, flying over and beyond the trap. This galvanized the trappers into instant action and we, likewise, rushed forward, unwilling to miss a single step in the procedure we had come to witness. We found the apex of the V was open and led into a long tunnel of wire mesh, in which a number of birds were fluttering madly. This tunnel, the functional part of the trap, had been constructed by unrolling the wire and securing the edges to the ground with wooden pegs. Enough slack remained to allow the wire

to be propped up, tent-like, by means of slender sticks about two feet long and notched at one end. One end of the tunnel was blind and the other, of course, communicated with the opening in the apex of the V. As a final touch, the tunnel had been lightly covered with brush. While we were making the above observations, the trappers were engaged in removing the props from the tunnel, and the wire fell upon the two dozen birds that had been captured, pinning them to the ground without apparent injury. Stones were placed here and there on the wire to hold the birds more securely and the captives were then carefully removed and placed in containers. The trap was reset and the trapping crew was again ready to proceed.

Another trap was located not far from the one just described and the covey was rounded up and driven toward it. When this second trap had taken its toll of birds the covey was driven back to the first one. This process was repeated again and again, the birds being driven

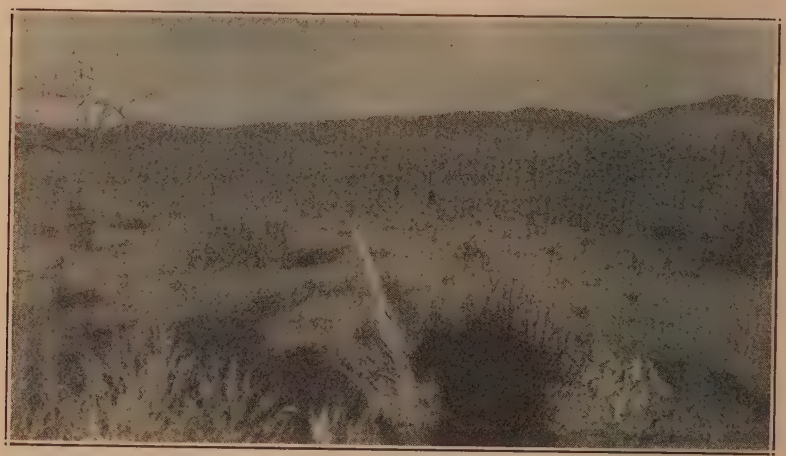

FIG. 138. San Telmo Valley, Lower California. Note line of quail drivers. Photo by G. H. True, Jr., January 31, 1934.

in a rough circle and into each trap, in turn, until they had become so wary that none would enter the tunnels. Senor Felix explained that the trappers would now locate another covey, set their traps in a similar fashion and repeat the process just as we had seen it. Another trapping crew was working some distance westward and were employing essentially the same method with the additional factor of a line of brush fires set by the trappers as they moved along. This it was explained, was to prevent the quail from doubling back and is used wherever the cover is exceptionally heavy.

We were next conducted to the "holding pen," a large expanse of wire mesh pegged to the ground and covered with brush. Beneath the wire a number of birds were imprisoned and their lot was certainly not an enviable one. Although an attempt had been made to prop the wire up by means of short sticks, the birds had little room for movement and were forced to content themselves with remaining in one position. Food and water had been provided but it is doubtful if the

birds either fed or drank while in such confined quarters. There they were to remain, however, until a sufficient number had been collected to warrant a trip to the border. In some instances, we were told, old adobe houses had been utilized as holding pens but the above-described method was, unfortunately, the one most commonly employed.

There is little to criticize in the quail trapping method just described. It is an ingenious method and one admirably suited to Lower Californian conditions, though it would be of little use in a region only sparsely populated with quail made wild by continual shooting. The "driving method" as depicted here is distinctly advantageous in that only a relatively small percentage of birds is taken from each covey insuring a permanent breeding stock and a consequent large annual crop of young birds. The methods employed in holding and handling the birds are in contrast to the trapping procedure open to considerable criticism. When one considers that the birds were held for at least several days, and often as long as a week, in close confinement with virtually no food or water, and were then subjected to an arduous two hundred mile journey in poorly ventilated trucks, it appears strange that the losses were no greater. The fact that so many birds survived that sort of treatment is a tribute to the hardiness of the species. The trip to San Telmo was made in order that a thorough investigation of Mexican methods might be conducted and to so alter the plan of operations that losses might be reduced to the minimum.

The quail imported from Lower California are not identical to the birds that we know as natives of southern California. The San Telmo quail is referred to in scientific journals as *Lophortyx californica plumbea,* a subspecies of the California quail that inhabits the coastal regions of the State. It differs but little, however, from the valley quail, *Lophortyx californica vallicola,* in either habits or coloration and is adapting itself admirably to a new environment. Even in such a poor quail year as 1934 has proven itself to be, we have found the Lower Californian birds mating freely with not only their own kind, but with native birds as well, and the pround father of many a family of young quail produced this year on California refuges displays the slightly reddish head that proclaims his alien origin.

In all, 8297 live birds completed the journey from San Telmo to Chino of which 7517 were released after a short stay at the game farm. Seven hundred and eighty quail remained at the game farm as breeding stock, to be released at the close of the hatching season. The imported quail cost the sportsmen of California exactly $1,918. This sum represents not only the actual cost of the birds but includes as well the cost of trapping permits and the salary of the Mexican inspector stationed at San Telmo. The cost per bird planted was a fraction more than twenty-three cents.

As the above figures indicate, we have imported less than 10 per cent of our quota of one hundred thousand quail. This was due to the fact that trapping activities commenced after the optimum trapping season was over and were limited by inclement weather and the rapidly approaching mating season. In addition, the difficulties involved in the transportation of the birds to the border tended to limit the number of shipments.

The plan to be followed this year will, it is hoped, result in the completion of the quota. Briefly, it involves the establishment of a base of operations at San Quintin, a Lower California seaport. There the birds will be held, sorted, banded, and then shipped to California by boat in lots of at least ten thousand. The birds will be taken to San Quintin at the close of each day's trapping activities and need not be held as they were at San Telmo. The quarters available at the seaport are spacious and will allow the birds to be held with a minimum of injury. The altered method of procedure should finally result in better quail shooting in southern California.

QUAIL BANDING RETURNS FOR 1932 AND 1933

By Gordon H. True, Jr.

In July, 1932, the Division of Fish and Game inaugurated the practice of banding the quail liberated on sanctuaries in southern California, with the conviction that, through banding, important data relative to the quail refuge program would be obtained. Already we have learned much concerning the spread of birds from various points of liberation and the data gathered relative to the survival of game farm reared quail have enabled us to answer the critics who condemn the practice of liberating pen-raised birds and question their successful reproduction under natural conditions. In addition to possessing a certain scientific value, the bands serve to remind the hunter of the efforts that are being made on his behalf.

Fig. 139. Catching quail prior to banding at Los Serranos State Game Farm, Chino. Photo by G. H. True, Jr.

A band encircling the leg of a quail may provide us with information in two ways. The actual return of a band after the bird has been shot constitutes one of these. The second way is through the provision of an easy means of field identification since banded birds may be easily picked out from the others by the use of field glasses or the unaided eye. This paper deals primarily with the first-named method of securing data, but before proceeding directly to a discussion of band returns, a general treatment of the banding program is advisable.

Over a period of time beginning in the month of July, 1932, and ending August, 1934, 16,728 valley quail have been banded and released south of the Tehachapi. In addition, 839 Gambel quail have been banded and liberated. Of the valley quail, 7517 were wild birds imported from the west coast of Lower California and the balance were reared on the State game farm at Chino.

A number four aluminum poultry band has proved to be the most satisfactory for quail banding purposes. The bands are serially num-

bered and bear the printed request that they be returned to the Division of Fish and Game. The first bands used were inscribed with the number and "Notify Game Comm." on the outside and the address to which the bands are to be sent, "San Francisco, California," was to be found on the inside of the aluminum circlet. It was learned, however, that the hunter seldom opens a band and, in consequence, any inscription on the inside may be overlooked. On the bands now in use, therefore, the entire legend, "Return to F. & G. Com. S. F." may be read on the outside. The above may appear to be of minor importance to the reader, but so anxious are we that bands taken by sportsmen be returned that we wish to leave no stone unturned—even in the case of such a relatively simple matter as a band inscription.

FIG. 140. Banding Lower California quail prior to release, Antelope Valley. Photo by G. H. True, Jr.

A careful record is kept of all band numbers, each one being entered on an especially prepared record sheet. With the number is listed the age of the bird, the sex, the point at which it was released and the date thereof. In addition, a column is reserved for such data relative to the recovery of the band as the date, locality and the agent. The latter may be, and most frequently is the hunter. A predatory mammal or bird, or even accidental death may, however, be responsible for the recovery of a band. Upon the receipt of a band, a card is mailed to the person making the return thanking him for his cooperation and setting forth, for his information, data relative to the release of the bird that wore the band. To this card is attached a return postal card on which the sportsman is requested to set down specific information concerning the point at which the band was taken by reference to some well known landmark. Up to the present time this system has met with a very satisfactory response on the part of the quail hunter. Individuals have failed to return cards, as requested, in only a few instances.

In reviewing the band returns for the 1932 and 1933 seasons the author does not attempt to make a lengthy analysis of the results.

The banding system has not been in vogue long enough to allow many definite conclusions to be drawn. At the end of the year 1932 only 10 bands had been returned. Of the 10 birds, six had been shot and four taken by other means. This small return may be accounted for by the fact that up to and including the 1932 open quail season only a relatively few birds had been released and, further, the sportsmen had not yet become acquainted with our work. It is presumed, however, that the ten bands represent only a fraction of the total number taken. By the close of the 1933 season a total of 59 bands had been recovered, the increase over the previous year being the result of a vast increase in the number of birds released and a considerable extension of the area over which the liberations were made. Again, as in the case of the 1932 returns, it is believed that the number of bands received was far less than the actual number of banded birds killed during the season.

The reports of 1933 show that of the 59 returns, 10 were made anonymously and 25 separate individuals were responsible for the recovery of the remaining 49. The largest number returned by one individual was nine while two hunters recovered six and five bands respectively. Five men averaged three birds, the same number took two and 13 recovered one band each. The average number of banded birds taken per hunter was slightly less than two, since only 49 were actually killed by shotguns. Ten birds died by other means, one being killed by an owl, another taken from the stomach of a Cooper hawk, and so on.

In the case of 35 of the birds killed we were able to learn the exact date on which the shooting took place. An average period of 113.6 days had elapsed between the date on which each of the above 35 quail was liberated and that on which it was taken. The maximum period of liberty was, in the case of two birds, 480 days and one had been at liberty but 16 days before being killed—this last being the minimum. These data show conclusively that game farm reared birds are able to survive under natural conditions.

Of the 59 bands taken, 26 were from Riverside and San Bernardino counties, 20 from the Antelope Valley region of Los Angeles County, and one from San Diego County. It should be explained that the above mentioned areas correspond with the three groups of quail sanctuaries that have been established in southern California and, further, that in the case of the San Diego County group but one liberation had been made prior to the 1933 quail season. In addition to the birds from the vicinities of these southern California refuges, two were taken in the northern part of the State, near Morgan Hill, and were products of the State Game Farm at Yountville, which institution is likewise carrying on the banding program. The two birds taken in the north complete the total of 59, which includes representatives from 15 distinct liberations.

Only 25 of the returns included really accurate information concerning the exact point at which the birds were killed. From these data, however, we have been able to calculate the distance of the point of recovery from the point of liberation, the maximum being 10.5 miles and the minimum, one mile. The average distance was 4.86 miles.

These distances, measured on a straight line, are the shortest routes over which it was possible for the quail to travel.

As a brief summary of the bird banding activities, it may be stated that as a result we may determine among other things where refuges may be most advantageously located and how far they should be spaced to insure the maximum amount of shooting in the intervening territory; what amount of successful shooting results from the refuge program; to what extent farm reared birds will mate and produce young under natural conditions; and the fate of wild birds that have been introduced from the outside.

In order that full advantage may be taken of our quail banding efforts, it is necessary to have the complete and willing cooperation of all interested sportsmen. It is hoped that this exposition of what has been already planned and accomplished may be an aid to that end.

THE FRESHWATER COMMERCIAL FISHERIES OF CALIFORNIA*

By Richard S. Croker

There was a time when the river fisheries of California surpassed those of the ocean, but that was many years ago. Saltwater fishing methods have been improved so as to take greater toll of the schools of ocean fish, canneries have been established and enlarged, and the rapid growth of coastal cities has opened up larger markets, so that now the ocean catch far exceeds the take of the freshwater. Of the hundreds of millions of pounds of fish caught every year in California, less than five million are taken from inland waters. Nevertheless, many fishermen derive their livelihood from the rivers and lakes of the central part of the State.

The most important fishes taken in the rivers of California are anadromous species, that is, fish that spend the greater part of their lives in saltwater but enter the rivers for spawning purposes and occasionally to feed. These are the king and silver salmon, the striped bass and the shad. The extensive gill net fishery for these species is well known and as it has been covered in previous publications of the California Division of Fish and Game, it will not be taken up in the present article. Two other anadromous fishes, the sturgeon and the steelhead, were formerly taken commercially. The capture of the former was prohibited in 1917 to preserve it from extinction, and the latter, due to depletion, has been removed from the commercial list.

It is with the true freshwater fishes that we are concerned at present. There are eight species of these that are caught commercially in California. All of them descend at times into the brackish waters of bays and estuaries, but they are essentially freshwater species. Five of them are native to central California waters. These are the split-tail (*Pogonichthys macrolepidotus*), the Sacramento pike (*Ptychocheilus grandis*), and two species known as hardheads (*Orthodon microlepidotus* and *Mylopharodon conocephalus*), and the western sucker (*Catostomus occidentalis*). The other three species were introduced into our waters by the California Fish Commission during the latter part of the last century. The carp (*Cyprinus carpio*) came from Asia by way of Europe and the eastern United States. The square-tail catfish (*Ameirus nebulosus*) and the fork-tail catfish (*A. catus*) came from the Mississippi Basin. The carp, split-tail, hardheads, and Sacramento pike are all members of the carp or minnow family, Cyprinidae.†

In 1933, the recorded commercial catch of the eight freshwater species totaled about 580,000 pounds. The value of these fish to the fishermen was approximately $28,000. The catfish, principally the fork-

*Contribution No. 139 from the California State Fisheries Laboratory, May, 1934.

† The fork-tail catfish is sometimes called "blue catfish," and the square-tail is sometimes referred to as "yellow catfish." The Sacramento pike is occasionally called "squawfish," and the hardhead is sometimes known as "blackfish," especially in Clear Lake. The names used in the text are those authorizd by the California Division of Fish and Game.

tail species, is by far the most important freshwater species, both in amounts caught and in value. (See Figs. 141 and 144.) The supremacy of the catfish is usually more marked than it was in 1933. All other freshwater fishes, with the exception of game species, such as black bass and trout, are grouped together by the fishermen and called "rough fish," "coarse fish" or "Chinee fish." The latter term originated from the fact that the Chinese are particularly fond of these species.

Within the boundaries of our State there are thousands of miles of rivers and streams and hundreds of lakes. In years gone by, commercial fishing was carried on in every bit of accessible water that contained fish. All the coastal streams contributed trout, salmon and sturgeon to the markets at San Francisco. Lake Tahoe and the Truckee River were once important trout producers. The Sacramento River supplied the fish for the Pacific coast's first salmon cannery over seventy years ago, and has remained an important fishing region ever since. Clear Lake in Lake County annually produces a con-

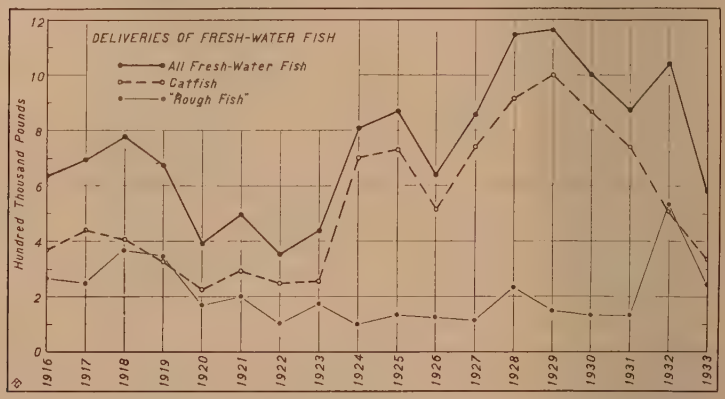

FIG. 141. The deliveries of the eight species of freshwater fish in the State of California, by years, 1916-1933. Note that the catfish landings generally dominate the fishery. Amounts given in round weight.

siderable harvest of fish. Buena Vista Lake, now shrunken to a swamp, and Tulare Lake, now dry, furnished quantities of fish not so many years ago, before reclamation projects encroached on their borders and irrigation districts diverted their water sources. Nigger Slough in Los Angeles County furnished carp in abundance before it was drained about fifteen years ago. Salton Sea, a great saltwater lake in the Imperial Valley, has long been the scene of operations of commercial fishermen. Scattered ponds, lakes and streams throughout the State have also contributed at times to the commercial fish catch.

Today, restrictive legislation, passed to preserve the natural resources of the State, confines commercial fishing in inland waters to but a few localities. The most important of these is the Sacramento-San Joaquin River system, which furnishes the bulk of the catch.

In the extensive area of the Central Valley, there are many hundreds of miles of water open to commercial fishing. These include the main channel of the Sacramento River from Vina in Tehama

County down to the mouth, the San Joaquin River below Stockton, Steamboat Slough, Sutter Slough, most of the connecting water courses in San Joaquin and Contra Costa counties, and Suisun Bay. Practically no commercial fishing is carried on above Sacramento or for freshwater fish in Suisun Bay, but all the intervening legally open waters are thoroughly exploited.

The total catch of freshwater fish (exclusive of anadromous species) in this district in 1933 amounted to 374,000 pounds. In former years the catch was very much greater, but since the World War it has only once (1929) exceeded the million-pound mark. (See Fig. 142.) Several factors contributed to the diminution of the fishery during the years just before the war. Reclamation projects deprived the fish of spawning and feeding grounds; irrigation districts diverted water; unscreened irrigation ditches caused destruction of many young fish; and fishermen formerly harassed and caught

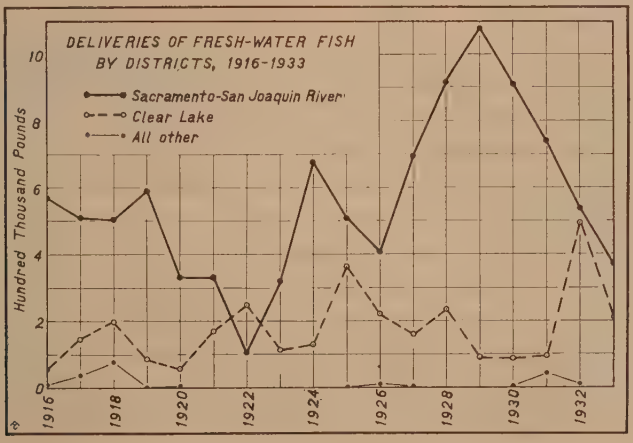

FIG. 142. Yearly landings of all species of freshwater fish by districts, 1916-1933. Note that the Sacramento-San Joaquin River district leads, followed by Clear Lake. The other districts include the catch in southern California lakes and reservoirs principally. Amounts given in round weight.

spawning fish. The main river and connecting sloughs above the city of Sacramento remained productive, although on a diminished scale, as late as 1918, but since that year there has been practically no commercial fishing above Sacramento. Washington Lake, across the river from Sacramento, at one time was very productive as was Sacramento Slough near the mouth of the Feather River, but both are now dry. Reclamation projects disturbed the rough fish most. These have become so scarce that their former good market has vanished because of the resulting absence of a steady supply. Formerly carp and catfish were shipped in carload lots to Eastern markets but when the supply failed in large measure, the Eastern dealers turned to other sources of supply. At present the bulk of the production of California freshwater fish is consumed locally.

During the war, the increased demand for fish maintained the catch at a fairly high level, but the post-war depression affected the river fisheries and the catch decreased markedly. From 1922 to 1929 the total catch of freshwater fish in the valley-delta area increased considerably. (See Fig. 142.) The larger catches were probably not the result of greater availability of the fish but of the increased demand and correspondingly greater effort on the part of the fishermen. The number of fishermen has not increased in proportion to the rise of the catch, but each fisherman now uses many more nets than he did ten years ago. The recent depression has resulted in a curtailment of fishing effort since 1930 and the catch has slumped to a marked extent.

FIG. 143. The Sacramento River near Courtland, typical catfish water. Photograph by R. S. Croker, April, 1931.

The greater part of the catch of freshwater fish in the river district is composed of catfish. The delicate flavor of this fish is known and appreciated, resulting in a relatively good sale. The towns of the Sacramento-San Joaquin Valley and the San Francisco region are the best markets, but quantities are shipped to Los Angeles. Occasional shipments are still made to the Rocky Mountain States, especially to the cities of Denver, Butte and Salt Lake. Californians prefer the white meat of the fork-tail, whereas the people of the Mountain States prefer the reddish flesh of the square-tail species. The Chinese like the large fish, those over 12 inches long, and prefer to get them alive. The smaller ones, 9 to 12 inches long (7 to 10 inches, dressed) find favor with other consumers who usually buy in small amounts yet wanting several individual fish.

The fishermen deliver catfish to the markets dressed, that is, with the heads, skins and viscera removed.

They receive 8 to 18 cents a pound for dressed fish and 4 to 8 cents a pound for the relatively small amounts of live fish sold to Chinese dealers. In cleaning, the catfish loses 50 per cent of its weight. The catch figures collected by the Division of Fish and Game and shown in their various publications are of the deliveries of fish as made by the fishermen, which in the case of catfish, is just half of the round weight. As the deliveries of other freshwater fish are given in round weight, it has seemed advisable to double the recorded weight of catfish to facilitate comparison with the other species. This has been done throughout this article, unless otherwise noted, but has not been previously done in other California State publications.

In the river district, the carp is second to the catfish in order of pounds landed, but the prices paid for it are so low that it ranks but third in value. Consumers of carp prefer to buy their fish alive, and as they will live in a small tank indefinitely they are often retailed while still wriggling.

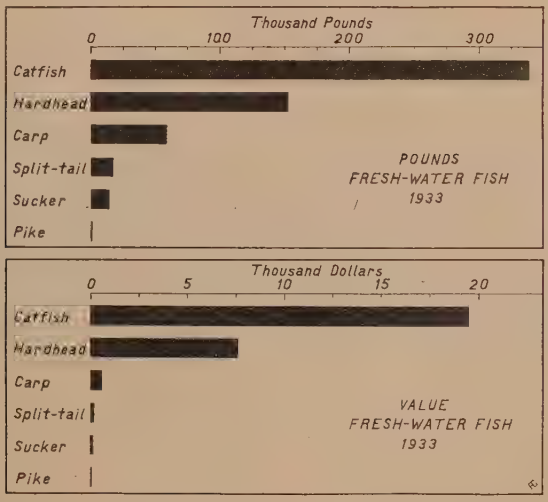

FIG. 144. Deliveries and values of each of the species of freshwater fish taken commercially in California in 1933. Amounts given in round weight.

Because of the poor demand for carp, the fishermen receive nothing for small lots mixed with other fish, and seldom receive more than 2 cents a pound for larger loads. The average price in 1933 was 1 cent per pound.

In the river fishery, the hardhead is third in poundage and second in value. It is the favorite of the Chinese as it will remain alive in captivity and has a sweet flavor, although it is rather bony. The price paid to the fishermen for live hardhead is sometimes as high as 20 cents a pound, averaging about 10 cents in 1933. Those brought to market dead bring 2 to 4 cents a pound. The price, as with other "Chinee fish," is highest in the spring when they are scarce and lowest in the fall when they are most easily caught. The market will

not absorb any large quantities of hardhead, so the price can be maintained only by holding the catch to a low level.

TABLE 1—PRICES PAID TO FISHERMEN

The average price paid to California fishermen for the several species of freshwater fish. The low price paid for hardhead in 1933 was due to large scale operations of seiners in Clear Lake and to the fact that much of the hardhead was marketed dead rather than alive as usual (see text).

Species	Average price per lb. 1926–29	Average price per lb. 1930	Average price per lb. 1933
Catfish*	$0.14	$0.135	$0.115
Hardhead	.11	.13	.05
Pike	.04	.06	.05
Sucker	.03	.05	.01
Split-tail	.05	.03	.01
Carp	.02	.02	.01

*Price given for catfish only is the price paid for dressed fish; to obtain a value comparable to other species, divide above price by two.

The split-tail, Sacramento pike and sucker are unimportant, although good prices are occasionally paid for small quantities of them when alive. The Chinese of the valley and bay regions are the principal consumers of these fish.

Besides the recorded catch of these fish delivered to wholesale dealers, there are tons of freshwater fish caught and sold direct to the consumer. The ranchers and others who live near the fishing grounds buy quantities of dressed catfish from the fishermen. The managers and cooks of the Chinese and Filipino ranch gangs, working in the neighborhood of the river, buy their fish direct from the fishermen. They purchase both dressed and live catfish and live rough fish. The amounts thus sold are considerable, and the money realized by their sale is an important item.

Only the adult rough fish are used for food. The young of the hardhead, Sacramento pike, split-tail, and of another minnow or chub, *Lavinia exilicauda,* are used as live bait by striped bass and black bass sport fishermen in the river region. Many commercial fishermen make some additional money by catching and selling small minnows for bait. They catch them in baited traps and keep them alive until sold. During the summer when the commercial catfish season is closed the sale of minnows is almost a necessity for some of the fishermen.

The universally used type of gear in the river district is a baited trap known as the fyke net. This net is used for the capture of all the species of freshwater fish. Some carp are caught in the shad, bass and salmon gill nets in the lower river, but there is no regular gill net fishery for freshwater fish. In the old days, beach seines were employed in Washington Lake and enormous catches were sometimes made at one haul. At present beach seines are illegal in the river region.

The fishermen who take catfish are located along the Sacramento River from Courtland to the mouth, and on the rivers and sloughs between Stockton and the Sacramento River. Each has his own territory, including several miles of river and slough, which is conceded to him by the unwritten consent of the other fishermen. Most of the

fishermen locate as near as possible to the legally closed waters out of which the catfish sometimes venture. The fyke nets in the lower reaches of the river near Pittsburg are operated by gill netters as a side line.

Most of the fishermen live in houseboats moored to the bank. Usually the base camp consists of the dwelling boat, a cleaning barge, live cars, and a net tarring tank which is on the shore. The live cars, in which the fish are kept until marketed, are large boxes set in the water. They have holes or slits through which the water can circulate but which are small enough to prevent the escape of the fish. The boats from which the fishermen tend their nets are 16- to 20-foot skiffs powered with outboard motors.

Each fisherman uses 50 to 100 fyke nets. Some of the fishermen work in pairs, in which cases as many as 150 or more nets are employed. These nets are no more than stationary baited traps. (See Fig. 145.) The net consists of tarred webbing of 2½-inch mesh stretched over 5 iron hoops to form a sort of modified cone. The largest hoop is at the open end. A mesh sack containing bait is at the closed end. To get at the bait, the fish must enter at the open end of the trap. Mesh funnels on the second and third hoops direct the fish toward the bait but

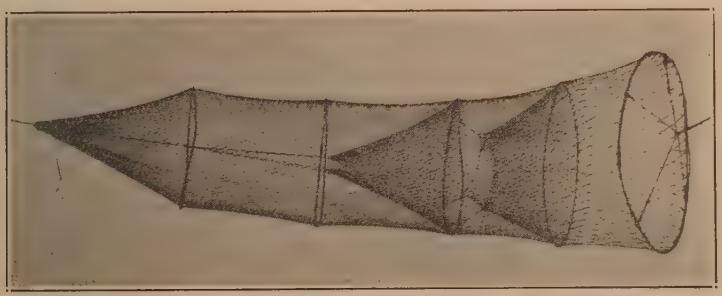

FIG. 145. A typical Sacramento River fyke net. The open end is at the right; the bait is kept in a bag at the small end of the net. To get to the bait, the fish must pass through the mesh funnels, which then prevent their escape. Photograph by D. H. Fry, Jr., Pittsburg, October, 1932.

hinder their escape. The nets are usually about 14 feet in length. In some nets the hoops taper from 4½ feet down to 2½ feet in diameter. Others have a 6-foot hoop at the open end and one of 1½ feet as the smallest. The cost of the average fyke net is about $20. The webbing must be dipped in coal tar every 30 days to prevent deterioration, resulting from contact with catfish slime. A number of years ago it was the general practice to place mesh wings on either side of the opening to lead the fish toward the trap, but the wings were held to be destructive and were outlawed. The fishermen now use an increased number of the wingless nets.

The fisherman places his nets in deep water close to the bank of the river or slough. The net is lowered to the bottom and a rope or wire from each end is made fast to an overhanging tree or stake on the bank. The ropes are made taut enough to keep the hoops upright. The lines are not marked, but rather are concealed from the prying eyes of net thieves. The nets are often stolen and more often robbed

of fish and thrown back in the water tangled beyond all hope of fishing success. During periods of unusually heavy depredations the fishermen fasten the ropes to underwater snags. In the spring when the catfish move upstream, the net is placed so that the open end faces downstream to intercept the fish. At other times it is immaterial which way the opening faces.

The best bait is fresh sardines. The fishermen obtain the sardines from the dealer to whom they deliver their catch. Most of the sardines are caught at Monterey and San Francisco. During the sardine canning season the Pittsburg fishermen obtain their bait from the canneries at that point. As each fisherman uses 500 to 1000 pounds or more of sardines every week, the fyke net fishery is of some importance to the sardine fishery. When fresh sardines are available, the fishermen buy more than they need and salt the surplus for times of scarcity. Salted sardines are nearly as good as fresh ones.

The fisherman leaves his nets in the water for 24 hours or more. The nets which are placed in the best locations are lifted every day, others are left 2 days, and those in the poorest places sometimes are left for 3 or 4 days. The fish do not suffer from the confinement as there is plenty of room to swim around inside the trap.

In making his rounds the fisherman runs his boat directly over the net and hauls on the line fastened to the open end, pulling the whole net into the boat. The swarms of small bait-stealing fish make their escape through the coarse mesh as the net is lifted. The fisherman raises the closed end and shakes the net so that the entrapped fish fall through the open month into the bottom of the boat. Then he replenishes the bait and lowers the net. On the way to the next net he returns the illegal and undesirable fish to the water. In spite of the 2½-inch mesh, some undersized fish are taken. The minimum size limit for catfish is 9 inches total length or 7 inches exclusive of any part of the head. The catfish are very hardy and stay alive until the base is reached. Here they are thrown into the live cars until the fisherman is ready to dress them. The few remaining undersized fish escape through the cracks or are sorted out during cleaning.

The method of cleaning catfish is ingenious. The cleaner makes a shallow cut between the top of the head and the dorsal fin, impales the head on a hook which is fastened to the wall, seizes the skin at the cut with a pair of pliers, and pulls the skin off in one piece. Then he grasps the body and pulls it away from the head. The viscera stay with the head and the flesh is free from everything except the bones.

Some of the fishermen have their own trucks and deliver to the markets at Sacramento, Stockton or Pittsburg. The fish companies send out trucks to pick up the catch of the others and to take bait to them.

The open season for catfish and other species taken in fyke nets in the river district is from September 1 to April 30. Spring is generally the best time for catching catfish. In midwinter they do not come to the bait. At this time the fishermen often put 8-foot hoops in front of the regular fyke nets and set them at the surface to catch "Chinee fish" which they sell direct to the neighboring Chinese. During the somewhat muddy water of early spring, the catfish start moving upstream out of the deep holes where they are alleged to have spent the

winter. They are hungry and enter the traps freely. In years when the river is low and clear in the spring, the catfish do not seem to move much. The poor spring fishing of some seasons has been attributed to low water by the fishermen.

Second only to the Sacramento-San Joaquin River district in the production of freshwater fish is Clear Lake. This beautifully situated body of fresh water is technically part of the Sacramento River drainage system in that its surplus waters flow into that stream. However, during the present series of dry winters there has been practically no run-off to the river. Clear Lake contains the same native species of commercial and game fishes found in the Sacramento. The square-tail and fork-tail catfishes, the carp and various game fishes have been introduced into the lake with success.

The catch in Clear Lake varies greatly from year to year due to fishing conditions and economic factors. The trend was upward from 1916 to 1925, in which year 360,000 pounds were taken. (See Fig. 142.)

FIG. 146. Seining for "rough fish" in Clear Lake. Preparing to lay out the 1200-foot seine from the apron of the barge. Photograph by H. B. Nidever, January 7, 1932.

During the years from 1926 to 1931, the catch decreased considerably. Until 1931 the greater part of the catch consisted of catfish, principally the square-tail species. From time to time quantities of rough fish, mostly carp, were caught in the lake but the take of these fish never approached that of the catfish. In 1931 the State Legislature passed a law prohibiting the shipment of catfish out of the district in which Clear Lake is located, and as a result it has ceased to be an important factor in the lake fishery. On the other hand, in 1932 the Division of Fish and Game issued a permit to a group of fishermen allowing them to seine coarse fish from the lake. It is due to the operations of these men that the Clear Lake catch showed a large increase in 1932. (See Fig. 142.) Practically all of the 1932 and 1933 catch in the lake consisted of rough fish, mostly hardhead.

The best fishing in Clear Lake has always been in the winter and early spring with few fish of any kind being taken during the summer and fall. The lake is at present open to fishing throughout the year.

The standard type of gear for taking catfish was formerly the trot line. This is a set line bearing many hooks. The best bait for catfish is sardine. Since 1931 hand lines or rod and line have been the only legal types of gear for catfish. The fishermen formerly shipped their catfish to Sacramento or San Francisco for marketing.

Seines are used for catching rough fish in the lake. The fishermen operate under a permit which requires them to return all catfish and other game fish to the water alive. Commercial fishing licenses are required also. It is hoped that the seining will reduce the numbers of coarse fish which are so numerous in the lake that they are considered pests. A barge which can be moved to different parts of the lake is the base of fishing operations. The large seine is set out from the barge by a motor boat, and is hauled in with power winches. (See Fig. 146.) Trucks are used for shipping the fish to market in San Francisco and Sacramento. The trucks are equipped with tanks so that live fish can be transported. The fish not sold are donated to charity or used for fertilizer.

Commercial fishing in other inland bodies of water in California is now on a permit basis. From time to time it seems advantageous to remove excess carp from reservoirs and natural lakes where they have become too numerous. The fishermen use beach seines and sell their catch if they can although the sale is of secondary importance. The catch records show only amounts sold to dealers. Guadalupe Lake in Santa Barbara County, Lake Elsinore in Riverside County, and the Los Angeles City reservoirs have all been seined at times for carp.

Nigger Slough, between Los Angeles and Wilmington, was once the habitat of numerous carp. Fish dealers in Los Angeles occasionally sent fishermen, equipped with beach seines, to the Slough to catch carp. The Slough was partially drained about 1918, and the fish perished.

Salton Sea was once an important fishing area for carp, humpback suckers (*Xyrauchen cypho*) and mullet (*Mugil cephalus*). The fishermen made their catches with seines and trammel nets, and shipped their fish to Los Angeles by train and truck. As the lake gradually receded and became more salty, the carp and suckers perished but the mullet fishery survived until 1931. Since then the Salton Sea fishery has been on a permit basis. The statistics on the catch from this body of water have never been adequate and are not included in the graphs accompanying this report.

The inland fisheries of California will not again surpass the ocean fisheries, but they may supply our markets with considerable quantities of excellent fish for many years to come.

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DIXON'S MULE DEER STUDY

The concluding installment of Joseph S. Dixon's article, "A Study of the Life History and Food Habits of Mule Deer in California," is the leading article of this issue. The first installment on "Life History" appeared in the July, 1934, number of this magazine.

Reprints of each of these articles have been ordered and will be available under one cover at a nominal fee.

GEORGE NEALE RETIRES FROM DIVISION

George Neale, for over 25 years a member of the Division of Fish and Game, and since 1928 chief of the Bureau of Fish Rescue, retired on pension on August 1, 1934.

Neale entered the employ of the Division in 1903. Prior to that time he had been a game warden in Sacramento County. Shortly after entering the service of the Fish and Game Commission, he was placed in charge of all deputies in 23 northern counties. He held this important position until 1922. In March, 1922, he was appointed executive officer, from which position he resigned in 1925.

So well versed in fish and game subjects, and especially fish, he was put in charge of the newly formed Bureau of Fish Rescue in 1928, which position he held until his retirement.

Neale developed the saving of game fish into one of the most important activities of the Division. At a cost of never more than $6,000 per year, he saved, annually, 4,000,000 of various species of sport fish. Fish that would have been swept to destruction by receding waters, improperly screened diversion points and the flooding of large areas of farm lands have been rescued and placed in waters that insured them being saved for the sportsmen's creels.

Few men in the Division had a wider knowledge of game and fish than George Neale, and he applied this knowledge to the benefit of the Division and the sportsmen.

The work of the Bureau of Fish Rescue has been incorporated with that of the Bureau of Fish Culture. Foreman Merrill Brown, who has had charge of the Friant black bass experimental ponds, will assume responsibility for the details of fish rescue and distribution so ably administered in the past by George Neale.—*O. L. Warner, August 24, 1934.*

FEDERAL MIGRATORY WATERFOWL REGULATIONS, 1934

The new regulations affecting migratory waterfowl provide that each State may take not more than 30 days for an open season on wild ducks and geese. A State may take 30 consecutive days, or it may take two, three, four, five, or six consecutive days, for as many consecutive weeks as will total 30 days. Such days as a State decides on must be the shooting days for each week until the end of that State's season. It is not possible under the new regulations to have a Wednesday and a Saturday shooting, but such days as are selected must be consecutive. A State may take less than the 30 days open season if the commissioners of that State believes the supply of ducks will not warrant a month's shooting.

California has the distinction of taking the shortest open duck season of any State in the Union, with 22 days, shooting on Saturdays and Sundays, from October 20 to December 30.

California's week end consecutive days was decided upon after Fish and Game Commissioners J. Dale Gentry, I. Zellerbach and Earl B. Gilmore had made a carfeul study of the waterfowl situation in California, and after conferences with sportsmen, originized and unorganized. They decided two days a week for eleven weeks would give the hunter plenty of time to get limits and at the same time conserve the supply of birds that light in this State. They reduced the total days each State might take by over 25 per cent, and though there was some protest at first, all true sportsmen are seeing the justice of the position of the commissioners.

Seasons selected by other western States are as follows: Oregon and Washington will take three days, Friday, Saturday and Sunday, for 10 weeks, starting October 18 and closing December 23; Montana will take the same three days, opening October 5 and closing December 9; Utah, Saturday, Sunday and Monday, opening October 12 and closing December 16; Colorado and Nevada, Saturday and Sunday, opening October 1, closing January 6; Nebraska and West Virginia are the only two States taking 30 consecutive days.

The bag limit for ducks in California will be 12 with a possession limit of 24. Only 5 or an aggregate of 5 of any of the following "imperiled species" may be included in a daily bag, with possession of 10; Eider, canvasback, redhead, greater and lesser scaup, ringneck, blue wing, green wing, cinnamon teal, shoveller and gadwall.

The limit on geese is 4 with possession 8; coot bag and possession 25; jacksnipe bag and possession 20.

It will be unlawful to kill Ross geese, wood, ruddy and bufflehead ducks, or swans.

Baiting of waterfowl regulations were also changed. To be able to legally bait waters and lands, application must be made to the

chief of the Bureau of Biological Survey. To receive a permit, after a thorough check has been made as to the advisability for such feeding, the applicant must agree to keep an accurate record of the persons shooting on the baited property; the total number of waterfowl killed; the various species bagged; number of blinds and number of occupants of each blind each day, and daily kill of birds by gunners in each blind; kind of feed to be used, intervals of baiting and that there be no shooting after 3 p.m. on open days. This record is to be sent to the Bureau within 30 days after the close of the season in the applicant's State.—*O. L. Warner, August 29, 1934.*

WESTERN ASSOCIATION OF FISH AND GAME COMMISSIONERS' MEETING, 1934

The fourteenth annual convention of the Western Association of State Fish and Game Commissioners, was held at Portland, Oregon, June 14th to 16th. This Association consists of the fish and game officials of the eleven Western States. It was organized in 1921 and the original meeting was called for the purpose, primarily, of forestalling further extension of Federal jurisdiction over fish and game. It can be truthfully stated that the Association ran true to the concepts for which it was originally organized. Nine of the eleven States which comprise the Association were represented at the Portland meeting. California was represented by J. Dale Gentry, president of the California Fish and Game Commission. Most of the States sent two or more representatives, which indicated unusual interest in the matters which were up for consideration.

The U. S. bureaus represented were the Forest Service, National Park Service, Bureau of Fisheries and Biological Survey. The different activities of these bureaus were represented by the western supervisors of such activities. British Columbia, which has many problems in common with those of our western States, was as usual well represented.

The meeting was presided over by M. L. Corrigan, president of the Oregon Game Commission. Mr. Corrigan has been an ardent sportsman throughout his life and has been a member of the Oregon Commission for many years. Both he and the personnel of the Oregon Commission are to be congratulated for the manner in which the meeting was conducted and the entertainment provided. Portland's famous "Rose Carnival" was under way and the delegates were made complimentary guests, a consideration greatly appreciated.

Commissioner Frank T. Bell of the U. S. Bureau of Fisheries appeared before the Association for the first time and discussed problems of common interest with the States, and expressed a desire to cooperate in further improving sport fishing.

W. C. Henderson of the Bureau of Biological Survey, discussed the migratory bird situation and emphasized the effects of drought and reclamation on the abundance of water-fowl in general. His was not a cheerful report and there was probably not a person present who did not personally feel that there should be no open season on migratory birds during the current year. Mr. Henderson explained what the Duck Stamp Bill will permit the Bureau to accomplish but regretted

the delay in getting clearance for Federal funds allotted for the acquisition of marginal lands.

Papers were presented by the different delegates covering the major problems which are continously before those engaged in solving conservation problems. Fish culture, planting, and upland game bird raising and distribution, received the usual attention and progress was reported, in most instances.

Everyone was on the "qui vive" to hear C. E. Rachford's discussion and explanation of U. S. Forestry Regulation G-20-A, which regulation contemplates taking over from the States jurisdiction of fish and game on national forest areas, whenever, in the judgment of the Secretary of Agriculture, the States are not cooperating with the Forest Service to the satisfaction of the latter. That the promulgation of this order, coming without consultation with the States, would meet with strenuous opposition, was indicated by the questions submitted to Mr. Rachford, and to requests for further enlightenment on the Forest Service's ultimate aims. After a day's discussion of Regulation G-20-A, the subject was referred to a resolutions committee. This committee submitted the resolution which appears herein, together with Regulation G-20-A, and the resolution received unanimous approval of the Western Association:

"Reg. G-20-A. When the secretary shall determine upon consideration of data and recommendations of the forester, that the regulation or the prohibition for a specified period of hunting and fishing upon any National Forest or portion thereof is necessary for the accomplishment of the purposes above set forth, he shall designate such National Forest or portion thereof, established hunting and fishing seasons therefor, fix bag and creel limits, specify the sex of animals to be killed, fix the fees to be paid for permits, designate the authorized official to whom application for permit shall be made, and describe the terms and conditions under which hunting and fishing shall be conducted with a view of carrying out the purpose of this regulation. Public notice of such designation shall be given by such means as the forester shall deem adequate for the purpose. Carcasses of animals or fish taken under permit shall be marked or tagged for identification as directed by the forester.

Reg. T-8½. Upon National Forest lands designated under Reg. G-20-A, the following acts are prohibited: Hunting, trapping, catching, disturbing, or killing any kind of game or nongame animal, or game or nongame bird, or taking the eggs of any such bird, except during hunting and fishing seasons established by the secretary, and in accordance with the terms and conditions of a permit issued by a duly authorized officer which is valid and subsisting at the time."

The resolution reads as follows:

"Your committee, appointed to study and report upon section G-20-A, of the order of the Department of Agriculture, has met and considered the said section and has heard arguments thereupon, and the committee unanimously reports as follows:

Since the days of early England it has been the unquestioned right of the sovereign to control the taking of fish and game. Prior to the Magna Charta, the title to fish and game was fixed in the crown, and since that time, and particularly since the adoption of the system of English common law by the sovereign States of the United States, it uniformly has been held that the title to the fish and game within the boundaries of a State is vested in that State, in trust, however, for the people thereof.

This theory has been upheld uniformly by the decisions of courts of last resort in every State where the matter has had judicial cognizance; and by the Supreme Court of the United States where it has been on appeal many times. It is submitted that, inasmuch as the question presented by Regulation G-20-A here in question already has had the judicial interpretation of our courts, the States affected should take a determined stand, that these judicial decisions shall not be reversed by usurpation by any ambitious governmental department or bureau.

We feel that the threatened enforcement of regulation G-20-A is an unlawful appropriation of the property of the people of a sovereign State which the officers of that State, and particularly the fish and game commissioners thereof, are sworn to defend. Any attempt on the part of a Federal bureau or agency to transgress upon this duty and right is in direct violation of all the principles of the organic acts and constitutions of the States involved, as well as of the Federal Constitution itself. It also is in direct violation of the spirit of all statutes and acts promulgated by the Congress of the United States, the legislatures of the several States, and of the judicial interpretations rendered thereupon.

We believe the States involved should, if necessary, curb this threat before same is accepted, in any part, by the public, for while the initial steps toward the enforcement of this section of the order may seem mild and only inconsequential in result, still it may be the initial step in complete usurpation of State rights amounting to confiscation of property without due process of law. We feel that the principle is entirely unsound, unjust and uncalled for.

Therefore, we respectfully recommend that all States involved unite in most strenuously resisting any attempt of the Federal bureaus in affecting the menacing threats contained in said order.

We have been and still are appreciative of any cooperative work done by the Federal bureaus in cooperation with the fish and game commissions of the several States in furtherance of propagation and protection of wild life, and we shall continue to welcome such cooperation so long as same does not ripen into usurpation of State powers; and to the end that the State rights be safeguarded and that any attempted usurpation might be checked at its inception, it respectfully is recommended that this association appoint an interim committee to consist of three members and to be appointed from the States constituting this association. Such committee to be appointed by the president and to devise ways and means to bring about an early determination of the question herein involved. Such committee to be subject to the call of the chairman of the committee."

Before adoption of the resolution, Mr. Rachford warned the association that the Forest Service might determine it advisable to exercise complete control over the National Forests, which would mean that the States would have no jurisdiction nor any rights thereon.

The 1935 meeting of the association will be held at Santa Fe, New Mexico. Present at the Portland meeting were D. H. Madsen, now with the National Park Service; R. G. Parvin, game commissioner of Colorado, and A. E. Burghduff, assistant executive officer of the California Fish and Game Commission, who assisted in organizing the association at Salt Lake in 1921.

The Resolutions Committee was composed of Federal Judge Colin Neblett of New Mexico, Dr. Irving Vining of Oregon and Newell Cook of Utah.—*A. E. Burghduff, July, 1934.*

PLANT SILVER SALMON IN EAGLE LAKE

Warden C. O. Fisher in cooperation with local sportsmen has planted 266,000 silver salmon in Eagle Lake, Lassen County. This is part of a state-wide experiment, utilizing to a greater extent this easily propagated species as a sport fish. Individuals grow rapidly and mature in three years. It is not expected that they will reach a size comparable to ocean grown fish, but it has been found that second year examples are much larger than rainbow trout of the same age. It is intended to follow this introduction with others annually until something definite is learned as to their success in the lake.

According to Fisher's observations, food in the form of young minnows (these of the genera Leucidius and Siphateles) locally known

as whitefish is abundant, and the introduced salmon began to feed upon them almost immediately.

The fish were transported in a truck in the usual manner, the cans unloaded on a raft, which was towed about the lake by a power boat. The fish were thus widely scattered, insuring a good distribution in areas well supplied with food. The plantings were made at intervals from July 14 to 28, 1934, with almost no loss.

FIG. 147. Transfer of silver salmon from truck to raft for distribution in Eagle Lake.

It may be remarked here that these were healthy and active fingerlings averaging over 3 inches in length, 14 to the ounce, samples of the exceptionally fine fish that have been grown this year at the new Lake Almanor Hatchery under the able supervision of Foreman William Berrian.—*J. O. Snyder, August 9, 1934.*

WATER STORAGE IN SANTA CLARA COUNTY

In the near future, six large dams will be constructed in the Santa Clara Valley Water Conservation District. The Coyote Creek dam will be 100 feet high with a reservoir capacity of 30,000 acre-feet. The others on Almaden, Calero, Guadalupe, Los Gatos and Stevens creeks are said to range from 21 to 115 feet in height and have a combined reservoir capacity of about 19,660 acre-feet.

It is stated that the reservoirs are for storage purposes, the waters to be used through percolation in the replenishment of well water in Santa Clara Valley.

It is presumed that fishing conditions in the region will not be greatly altered. Although the reservoirs do not give promise to addi-

tional fishing water because of their necessarily great variation in surface level the matter of an adaptable stocking policy is under consideration. Of late years, the winter migration of steelheads that formerly stocked these streams has become all but extinct, and the lower courses of most of the creeks seldom carry water to the bay. The proposed dams will not better this condition and it is altogether likely that the little natural spawning of trout that now occurs will entirely cease.—*J. O. Snyder, August, 1934.*

ADDITION TO LIST OF TOTALLY EXCLUDED BIRDS, STATE IMPORTATION LAW

In accordance with the provisions of section 9 of Chapter 76, Statutes of 1933, the Fish and Game Commission and the State Department of Agriculture have added the Hawaii rice bird (*Munia nisoria* Temminck), belonging to the Ploceidae or weaver finches. It is a native of Malaysia. This bird is therefore added to the list of totally excluded species listed under regulation 1, pages 3 and 4 of the "Rules and Regulations Governing the Importation of Wild Birds and Animals into the State of California and Conditions under which Same May Be Kept in Confinement."

The birds are dull colored, have no song that is worthy of the name and are rather unsatisfactory cage birds. Their food is primarily seeds of weeds and grasses. In rice growing districts, the principal food in seasons when available is the green or unripe rice grain. As the birds are extremely gregarious, the damage they do to rice is very considerable. In seasons when the rice is not heading, or when the grains are too hard, the birds feed on seeds of grasses and weeds.

COMMERCIAL FISHERY NOTES

SUMMER OCEANOGRAPHIC WORK

The oceanographic program of the State Fisheries Laboratory for the summer of 1934 consisted of seven trips on the patrol boat *Bluefin* in the waters of southern California. The patrol boat *Albacore* stationed at Monterey conducted experimental hauls with an otterboard trawl in order to demonstrate the effectiveness of larger meshed savings gear in taking flatfishes. This was done in addition to keeping up her regular schedule of observations as a part of the hydrobiological survey of Monterey Bay which is being conducted jointly by Stanford University and the Division of Fish and Game.

The first research trip of the *Bluefin* this season was the exploration of the waters off San Diego on March 5–10, to seine for the small "quarter-oil" sizes of sardines in an effort to estimate their abundance as compared with former years. This work, by H. C. Godsil and R. S. Croker of the laboratory staff, was for the purpose of determining in advance the relative number of the small sardines which would make up the entering size class appearing for the first time in the commercial catch at San Pedro in the fall of 1934. It was found that the "quarter-oil" sizes, resulting from the spring spawning, were scarce and as a result, the San Pedro cannery catch in the autumn would contain few very small fish as compared with the fall of 1933 when the smallest size class was unusually abundant.

A second trip in March was made by H. C. Godsil (March 12–16) to observe the abundance of large winter sardines farther offshore than the localities visited by the boats fishing for the canneries. During the winter of 1933–34 the fishing had been confined largely to areas close to shore so that we had insufficient knowledge of the presence of large adult fish off shore. Many large schools of "winter fish" were observed by Godsil south of Point Conception in the neighborhood of the channel islands, indicating that fishing had concentrated inshore taking advantage of available fish near by rather than because of a scarcity of sardines elsewhere in the San Pedro area.

During April two seining trips on the *Bluefin* were made to fishing areas off San Diego. The first trip, on April 1–4, was made by H. C. Godsil and R. S. Croker and the second trip was by R. S. Croker and D. H. Fry, Jr., on April 23–27. These trips confirmed earlier observations as to the scarcity of small sized sardines to be expected in the San Pedro commercial catch of the following autumn.

On May 14-18, a 600-mile trip on the *Bluefin* was made by R. S. Croker in southern California waters and on the high seas off Lower California as far south as Cape San Quentin, including Tanner, Cortes and other fishing banks. This trip was to locate albacore, if possible, as well as other tunas and to make observations on the occurrence of sardines in these areas. Albacore were not sighted and sardine schools were not located. The rough seas encountered on this trip might explain the failure to see sardines. Yellowtail and bonito were found in

abundance and ripe spawning bonito, both male and female, were found over a wide area, suggesting a rather extensive spawning range for the latter species. As a preliminary trial of the method of attaching tags to tuna, three bonito were tagged by R. S. Croker during the trip. The mechanics of tagging proved satisfactory so that we are now in readiness for an extensive tagging program in an attempt to dissolve some of the mystery as to the movements of tuna schools in the waters off Mexico and southern California.

A four-week trip (June 7-July 6) was made by H. C. Godsil down the coast of Lower California and into the gulf as far as La Paz. The purposes of the trip were to locate tuna schools and fishing banks, to initiate tuna tagging, to extend our knowledge of mackerel spawning time, density, and localities, and to continue our observations on the occurrence and spawning of sardines to the south of the State line. The mackerel and sardine observations made on the trip were very successful. Plankton net hauls were made for mackerel eggs and larvae at frequent intervals down the coast. Sardines were observed and samples taken from what appears to be a local population in the Gulf of California near La Paz. Tuna scouting was unavoidably curtailed and difficulty was encountered in keeping bait alive in the tank which had an insufficient circulation of sea water.

August 9 to 18 a trip was made by H. C. Godsil and R. S. Croker among the channel islands off southern California in an attempt to locate and tag albacore and other tunas. No fish were taken but the staff members are consoled by the fact that commercial fishermen also were unable to make catches in the same localities during the 9-day interval.

Other research trips planned for the *Bluefin* during the autumn will be postponed because of a change in schedule by which the patrol boat will be engaged in transporting wild quail from Lower California for planting in suitable locations in this State.—*W. L. S., August 21, 1934.*

UNCOMMON FISH TAKEN AT SAN PEDRO

A few unusual fish have been taken in the commercial fish catch of the San Pedro region within the past few months.

On March 15, 1934, a tongue sole, *Symphurus atricaudus,* was caught by the boat *President.* This is the only true sole occurring along the California coast and is taken only occasionally in the commercial catch.

Two specimens of *Macrourus stelgidolepis* have been brought into the San Pedro fish markets, one on March 9, 1934, and one on July 2, 1934. This is a relatively rare fish and has no common name. It belongs to the family Macrouridae. A related species, taken on the Atlantic coast, is called a rat-tail. Fish of this family are taken in comparatively deep waters. They are characterized by a deep body, narrowing abruptly to a long, slender tail. Our specimens were about 15 inches in length.

A sunfish, *Mola mola,* was seen at the San Pedro markets on September 28, 1933, and another on July 2, 1934.

The Japanese herring, *Etrumeus microps,* appears occasionally in the fish catches of these waters. On May 22, May 24, and June 11, 1934,

one of these fish was found with the mackerel catch. These three individuals were all females with ripening eggs and with a size range of 275 to 295 mm.—*Frances N. Clark, California State Fisheries Laboratory, August, 1934.*

ALBACORE

During the month of August, 1934, the fishermen of the Los Angeles district were taking albacore in commercial quantities for the first time in many years. The last run of any importance in this district occurred in 1930 and up to this year, with the exception of an occasional stray, no albacore have been taken in these waters.

Throughout the month of July, several single fish were taken in the roundhaul nets incidental to other fishing activities. During the first week of August, several of the cruising swordfish boats started locating albacore while trolling. In a few days a great many of the small gig boats were out prospecting for fish and catches of a few fish up to a ton were being landed both at the fresh fish markets and at the canneries.

Approximately fifty tons of the fish were delivered to the canneries during the first two weeks of August while the markets received about two tons during the same period. The price being paid to the fishermen was eight cents per pound at the markets and one hundred fifty-five dollars per ton at the canneries.

At the present writing (August 15) the run has fallen off and some of the old timers are rather skeptical as to whether or not the fish are going to appear in quantities large enough to be of any general value.

It is interesting to note that the fish were first observed and taken in the Los Angeles area and that no fish were taken at San Diego during the first appearance of the fish in local waters. During the second week in August, a few fish were taken at San Diego.—*L. G. Van Vorhis, Terminal Island, August 22, 1934.*

BLUEFIN TUNA

Bluefin tuna have returned to southern California waters and are being taken by the purse seine boats in good quantities.

The first catch was made in April and the local run started the early part of May. This is very unusual since the fish do not ordinarily appear before the first or the fifteenth of June. The catches have been very spotted and have varied a great deal in quantity. During the early part of the season, the landings were comparatively light, running from three to fifteen tons per boat. It was not until the first part of August that an unusually heavy run was experienced.

The 1934 catch, up to the middle of August, has been approximately ten million pounds. This is well above the ordinary catch although it amounts to only about half of the record take of twenty million pounds made in 1930—*L. G. Van Vorhis, Terminal Island, August 21, 1934.*

STATEMENT OF INCOME

For the Period July 1, 1933, to June 30, 1934, of the Eighty-fifth Fiscal Year

Departmental Income, Current Year—		
License sales:		
Angling licenses, 1932	$5,475 00	
Angling licenses, 1933	300,170 00	
Angling licenses, 1934	53,719 00	
Commercial hunting club licenses, 1933-34	1,750 00	
Commercial hunting club operators' licenses, 1933-34	395 00	
Deer tags, 1932	1,143 25	
Deer tags, 1933	95,776 00	
Deer tags, 1934	4 00	
Fish breeders' licenses, 1933	20 00	
Fish breeders' licenses, 1934	365 00	
Fish importers' licenses, 1933	5 00	
Fish importers' licenses, 1934	60 00	
Game breeders' licenses, 1933	130 00	
Game breeders' licenses, 1934	970 00	
Hunting licenses, 1931	261 30	
Hunting licenses, 1932-33	8,387 18	
Hunting licenses, 1933-34	330,779 00	
Hunting licenses, 1934-35	79 00	
Kelp licenses, 1934	50 00	
Market fishermen's licenses, 1933-34	25,040 00	
Market fishermen's licenses, 1934-35	24,440 00	
Trapping licenses, 1933-34	1,413 00	
Wholesale fish packers' and shell fish dealers' licenses, 1933-34	990 00	
Total license sales		$881,421 73
Other income:		
Contributions from importers	$324 15	
Court fines	27,107 56	
Fish packers' tax	192,637 06	
Fish tag sales	1,576 10	
Game tag sales	106 32	
Interest on bank balances	5,332 57	
Income from Department of Agriculture Fund—Chap. 825-33	45,131 65	
Kelp tax	116 76	
Lease of kelp beds	1,309 20	
Miscellaneous sales	1,248 07	
Publication sales	553 30	
Dividends California National Bank (50%)	18,545 08	
Dividends Trinity County Bank at Weaverville	178 50	
Total other income		294,166 32
Total departmental income, current year		$1,175,588 05

STATEMENT OF EXPENDITURES

For the Period July 1, 1933, to June 30, 1934, of the Eighty-fifth Fiscal Year

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Administration:					
Executive	$8,360 00				$8,360 00
Clerical and office	5,520 00	$1,090 37	$230 01		6,840 38
Printing, Fish and Game Magazine		2,175 52			2,175 52
Printing, general		3,469 94			3,469 94
Automobile		635 26	389 57		1,024 83
Traveling			3,232 79		3,232 79
Postage			4,392 22		4,392 22
Telephone and telegraph			3,966 12		3,966 12
Freight, cartage and express			631 95		631 95
Rent			13,354 66		13,354 66
Accident and death claims			4,491 92		4,491 92
Accounting pro rata	4,500 00				4,500 00
Legal	493 56		3,582 05	$81 32	4,156 93
Premiums on bonds			42 50		42 50
Publicity			438 25		438 25
Pro rata General Fund expense, Chap. 923-33			2,670 68		2,670 68
Total Administration	$18,873 56	$7,371 09	$37,422 72	$81 32	$63,748 69
Bureau Education and Research:					
Chief	$1,079 85				$1,079 85
Clerical and office	1,920 00	$35 91	$65 06	$3 07	2,024 04
Automobiles		491 83	258 63		750 46
Traveling			2,348 17		2,348 17
Postage			14 80		14 80
Telephone and telegraph			2 42		2 42
Photography		8 30	104 37	45 10	157 77
Freight, cartage and express			3 47		3 47
Library	1,080 00	27 86	73 17	197 87	1,378 90
Research	5,140 00	136 80	53 10	10 50	5,340 40
Publicity	2,450 00	41 50	34 29		2,525 79
Total Bureau Education and Research	$11,669 85	$742 20	$2,957 48	$256 54	$15,626 07
Bureau Patrol and Law Enforcement:					
Chief and assistants	$11,100 00				$11,100 00
Clerical and office	3,180 00	$53 50	$12 70	$56 86	3,303 06
Automobiles		27,780 04	10,858 88	9,699 29	48,338 21
Traveling			45,916 23		45,916 23
Postage			603 83		603 83
Telephone and telegraph			1,620 05		1,620 05
Freight, cartage and express			27 40		27 40
Rent			618 78		618 78
Captains and wardens	176,146 67	1,506 07	1,105 12	76 54	178,834 40
Launches		2,366 17	1,551 12	14 06	3,931 35
Fish planting	4,620 00	629 58	1,257 75	49 59	6,556 92
Volunteer deputies		102 50			102 50
Premiums on bonds			229 50		229 50
Temporary help	2,237 77				2,237 77
Cooks	1,500 00				1,500 00
Game refuge guard	720 00				720 00
Commercial fisheries patrol:					
Chief and assistants	2,760 00				2,760 00
Captains and wardens	14,355 50	13 83	17 66		14,386 99
Launches	11,291 29	5,373 21	2,766 31	293 95	19,724 76
Fish cannery inspectors, seasonal	9,333 18				9,333 18
Traveling			5,256 02		5,256 02
Rent			841 50		841 50
Automobiles		678 61	359 07		1,037 68
Temporary help	350 64				350 64
Total Bureau Patrol and Law Enforcement	$237,595 05	$38,503 51	$73,041 92	$10,190 29	$359,330 77
Bureau Commercial Fisheries:					
Chief and assistants	$13,620 00				$13,620 00
Clerical and office	9,596 34	$84 94	$23 96		9,705 24
Automobiles		347 29	254 51	$976 12	1,577 92
Traveling			5,694 22		5,694 22
Postage			60		60
Telephone and telegraph			585 77		585 77
Freight, cartage and express			129 73		129 73
Rent			146 92		146 92
Heat, light, water and power			361 37		361 37
Research	2,280 00	33 24		100 92	2,414 16
Laboratory	22,687 58	1,154 57	907 24	500 18	25,249 57
Fish tags		580 00			580 00
Statistics		855 45	2,016 00	143 30	3,014 75
Temporary help	88 39				88 39
Total Bureau Commercial Fisheries	$48,272 31	$3,055 49	$10,120 32	$1,720 52	$63,168 64

STATEMENT OF EXPENDITURES

For the Period July 1, 1933, to June 30, 1934, of the Eighty-fifth Fiscal Year—Continued

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Bureau Fish Culture:					
Chief and assistants	$7,185 00	$13 20	$160 50		$7,358 70
Clerical and office	4,080 00	23 94	12 75	$165 28	4,281 97
Automobiles		6,953 11	3,091 37	2,913 68	12,958 16
Traveling			7,867 58		7,867 58
Postage			219 53		219 53
Telephone and telegraph			1,198 29		1,198 29
Freight, cartage and express			896 25		896 25
Rent			2,774 04		2,774 04
Heat, light and power			1,640 01		1,640 01
Hatcheries	108,536 67	62,139 24	1,076 80	1,068 65	172,821 36
Fish cars	3,540 00	415 47	725 63		4,681 10
Blue printing		1 62	16 46		18 08
Cooperative research	3,110 71	637 58	1,762 81	22 67	5,533 77
Temporary help	1,520 35				1,520 35
Fish hatchery assistant, seasonal	21,646 04				21,646 04
Hydraulic engineering	2,400 00	50 26	957 72	225 28	3,633 26
Special field	7,340 00	99 76	5 50	94 79	7,540 05
Total Bureau Fish Culture	$159,358 77	$70,334 18	$22,405 24	$4,490 35	$256,588 54
Bureau Game Propagation:					
Chief and assistants	$5,460 00				$5,460 00
Automobiles		$630 88	$270 04		900 92
Traveling			2,250 61		2,250 61
Postage			72 79		72 79
Telephone and telegraph			174 10		174 10
Freight, cartage and express			40 59		40 59
Heat, light and power			1,300 07		1,300 07
Maintenance	13,005 71	10,039 86	448 63	$64 70	23,558 90
Temporary help	744 95				744 95
Quail trapping and expansion of quail program	4,726 07	1,641 77	2,493 59	492 18	9,353 61
Purchase of quail and pheasants		2,135 67			2,135 67
Total Bureau Game Propagation	$23,936 73	$14,448 18	$7,050 42	$556 88	$45,992 21
Bureau Fish Rescue:					
Chief and assistants	$4,800 00	$4 27	$42 24		$4,846 51
Traveling			107 56		107 56
Rent			109 00		109 00
Temporary help	117 00				117 00
Heavy truck service			1,187 20		1,187 20
Total Bureau Fish Rescue	$4,917 00	$4 27	$1,446 00		$6,367 27
Bureau Game Refuges:					
Chief and assistants	$8,500 00				$8,500 00
Clerical and office	1,920 00	$11 16	$12 50		1,943 66
Automobiles		557 97	182 96		740 93
Traveling			4,752 46		4,752 46
Telephone and telegraph			95		95
Lion hunters	5,479 00				5,479 00
Refuge posting	450 00				450 00
Predatory animal control			5,530 00		5,530 00
Refuge maintenance	8,145 50	3,282 35	2,199 81	$328 20	13,955 86
Predatory animal hunters and trappers, seasonal	5,600 00				5,600 00
Temporary help, seasonal	3,982 00				3,982 00
Total Bureau Game Refuges	$34,076 50	$3,851 48	$12,678 68	$328 20	$50,934 86
Bureau Licenses:					
Clerical and office	$13,140 00	$111 77	$22 04		$13,273 81
Printing, licenses and applications		15,776 06			15,776 06
Traveling			340 62		340 62
Postage			1,838 14		1,838 14
Freight, cartage and express			1,071 29		1,071 29
Premiums on bonds			1,177 50		1,177 50
Total Bureau Licenses	$13,140 00	$15,887 83	$4,449 59		$33,477 42
Total eighty-fifth fiscal year expense paid from support appropriations	$551,839 77	$154,198 23	$171,572 37	$17,624 10	$895,234 47

STATEMENT OF EXPENDITURES

For the Period July 1, 1933, to June 30, 1934, of the Eighty-fifth Fiscal Year—Continued

Function	Salaries and wages	Materials and supplies	Service and expense	Property and equipment	Total
Special items:					
Claim of Chief Accounting Officer of Department of Finance—Chapter 991-33				$2,259 11	
Construction of Russian River Jetties—Chapter 989-33				7,325 76	
Deer-tight fences—Chapter 872-31:					
From January 1, 1934, to June 30, 1934			$73 80		
From July 1, 1933, to December 31, 1933			1,498 05		
Total deer-tight fences—Chapter 872-31				$1,571 85	
Electro Metals Company's Claim—Chapter 599-31				18,750 00	
License commissions				38,313 71	
State Fair and other exhibits				538 32	
Total special items					$68,758 75
Permanent improvements:					
Construction, improvements and equipment					$67,496 43
Prior year expense:					
83d fiscal year				$82 35	
84th fiscal year				26,043 69	
Total prior year expense					$26,126 04
Bureau Commercial Fisheries— Chapter 825-33					
Fresh fish marketing:					
Chief and assistants	$4,490 47				$4,490 47
Clerical and office	1,139 03	$123 40	$11 55		1,273 98
Automobiles		6 50	19 42		25 92
Traveling			1,155 63		1,155 63
Postage			260 00		260 00
Telephone and telegraph			2 61		2 61
Freight, cartage and express			180 68		180 68
Rent			40 57		40 57
Exhibits		205 47	3,545 95		3,751 42
Temporary help	351 00				351 00
Printing		1,852 02			1,852 02
Pro rata administration			696 21	$103 79	800 00
Total Bureau Commercial Fisheries—Chapter 825-33—Fresh fish marketing	$5,980 50	$2,187 39	$5,912 62	$103 79	$14,184 30
Grand total proprietary group					$1,071,799 99

In addition to the above expenditures the following amount was transferred from the Fish and Game Preservation Fund into the State Employees' Retirement Fund $17,000 67

ANGLING LICENSE SALES, 1914-1933

Year	Number sold	Value	Year	Number sold	Value
1914	81,965	$84,417	1924	202,690	$210,988
1915	87,262	89,620	1925	222,983	232,501
1916	111,994	115,518	1926	246,167	256,629
1917	No record	125,572	1927	262,886	273,202
1918	No record	123,080	1928*	217,788	445,764
1919	No record	146,724	1929	225,774	471,826
1920	No record	163,183	1930	248,319	508,875
1921	176,873	183,319	1931	242,857	497,317
1922	183,116	189,738	1932	212,662	436,373
1923	225,171	232,995	1933	175,936	358,568

*Resident license fee increased from $1.00 to $2.00 each.

SEIZURES OF FISH AND GAME

April, May, June, 1934

Fish:	
Abalones, pounds	278
Barracuda, pounds	60
Bass—	
Black	38
Striped	105
Striped, pounds	29
Clams	2,622
Crappie, perch, sunfish	141
Cockles	610
Halibut, pounds	14
Lobsters, pounds	814
Scallops, pounds	34
Salt Water Perch, pounds	75
Salmon, pounds	1,370
Trout, all kinds, pounds	872
Yellowfin, pounds	1,992
Yellowtail, pounds	17
Nets	1
Fish traps	13
Game:	
Deer	11
Deer meat, pounds	205
Doves	5
Ducks	109
Pheasants	7
Pigeons	8
Quail	7
Rabbits	9
Non-game birds	11
Tree squirrel	1
Guns	2
Bird traps	1

FISH CASES

April, May, June, 1934

Offense	Number arrests	Fines imposed	Jail sentences (days)
Abalones; small; overlimit	41	$870 00	12½
Angling, no license	48	490 00	
Bass—			
Black; small	10	265 00	
Striped; small; overlimit	14	205 00	
Barracuda; small	3		
Clams; small; overlimit	46	560 00	30
Cockles; overlimit	2	50 00	
Commercial fishing license act; violations of	22	96 00	
Crappie, sunfish, perch; closed season; overlimit	17	255 00	
Halibut	1		
Nets, illegal	9	200 00	50
Trout; closed season; overlimit	50	1,200 00	47½
Lobsters; closed season	3	25 00	
Salmon; small	1		
Fish traps, illegal	3	135 00	
Fishing in closed waters	21	375 00	
Illegal fishing gear	2	5 00	
Miscellaneous fish cases	4	5 00	3
Totals	297	$4,736 00	143

GAME CASES

April, May, June, 1934

Offense	Number arrests	Fines imposed	Jail sentences (days)
Deer; closed season; killing does, fawns; spike buck	38	$775 00	495
Ducks; closed season	2	40 00	
Doves; closed season	2	75 00	75
Grouse; closed season	1		
Pheasants; closed season	6	75 00	450
Pigeons; closed season	3		
Quail; closed season	2	65 00	
Rabbits; closed season	4	25 00	
Tree squirrels	1		
Firearms in game refuge	8	80 00	
Hunting license act; violations of	11	108 00	
Non-game birds; killing of	1		
Spotlight hunting	4	165 00	120
Shooting from automobile	1		
Totals	84	$1,408 00	1,140

FRESH FISH IMPORTATIONS* FROM FOREIGN COUNTRIES FOR APRIL, MAY AND JUNE, 1934

Compiled by the Division of Fish and Game, Bureau of Commercial Fisheries

Species	Landed in Region 70, Los Angeles	Landed in Region 80, San Diego	Total pounds
Barracuda	9,685	21,495	31,180
Cabrilla	104,389	113,900	218,289
Corbina, Mexican	17,295		17,295
Grouper	25,467	15,440	40,907
Halibut, California	23,613	48,767	72,380
Mackerel, Pacific	20	90,846	90,866
Mackerel, Spanish	1,331	253	1,584
Perch		278	278
Rock Bass	10,428	37,497	47,925
Rockfish	12,429	39,499	51,928
Sardine		613	613
Sea-bass, Black	108,925	60,876	169,801
Sea-bass, White	4,002	43	4,045
Shark		604	604
Sheepshead		171	171
Sole		40	40
Totuava	96,217		96,217
Tuna, Albacore	916,470		916,470
Tuna, Bonito	1,144	71,868	73,012
Tuna, Skipjack	258,909	751,258	1,010,167
Tuna, Yellowfin	7,718,528	11,628,596	19,347,124
Whitefish	3,536	2,272	5,808
Yellowtail	118,612	387,836	506,448
Miscellaneous Fish	360		360
Crustacean:			
Lobster, Spiny	10,066	28,131	38,197
Mollusk:			
Clam, Cockle	7,800		7,800
Reptile:			
Turtle		2,601	2,601
Total pounds	9,449,226	13,302,884	22,752,110

*Included in tables of landings for Region 70, Los Angeles, and Region 80, San Diego.

CALIFORNIA FRESH FISH LANDINGS* FOR APRIL, MAY AND JUNE, 1934

Compiled by the Division of Fish and Game, Bureau of Commercial Fisheries

Species	Region 10, Del Norte	Region 20, Eureka	Region 30, Sacramento	Region 40, San Francisco	Region 50, Monterey	Region 60, Santa Barbara	Region 70, Los Angeles	Region 80, San Diego	Total pounds
Anchovy				35,080	96,770		27,236		159,086
Barracuda					52	1,861	540,250	142,829	684,992
Cabezone				190	2,837	81			3,108
Cabrilla							104,389	113,900	218,289
Carp			34,816				788		35,604
Catfish			24,402						24,402
Corbina, Mexican							17,295		17,295
Cultus, Pacific	3,717	22,564		119,457	16,689		1,002		163,429
Eel				23					23
Flounder, Starry			205	145,069	3,843				149,117
Flying Fish							15,200		15,200
Grouper							25,467	15,440	40,907
Hake		392		21,663	850				22,905
Halibut, California				14,883	7,984	52,783	137,412	73,207	286,269
Halibut, Northern	437	402,275		74,021					476,733
Hardhead			30,840						30,840
Herring, Pacific									100
Kingfish					100				138,641
Mackerel, Horse				5,013	35,157		98,465	6	86,262
Mackerel, Pacific					5,888		80,374		16,331,251
Mackerel, Spanish					171,709	471	11,468,692	4,690,379	1,584
Mullet							1,331	253	5,537
Perch							1,073	4,464	46,754
Pike	29	1,327		18,304	13,204	4,278	9,149	463	128
Pompano, California			128						2,487
Rock Bass					42		2,445		153,536
Rockfish				130	4	1,422	92,798	59,182	1,316,505
Sablefish	1,849	18,163		203,101	518,343	99,158	358,873	117,018	527,964
Salmon		166,738		116,544	23,189	8,677	212,364	452	1,402,238
Sand Dab	43,936	952,340	135,076	101,541	169,345				237,425
Sardine				229,092	5,087		3,246		541,125
Sculpin				10,710	499,795		27,107	3,513	14,440
Sea-bass, Black							13,807	633	182,456
Sea-bass, Shortfin						1,249	112,834	68,373	358
Sea-bass, White								358	250,574
Shad					495	2,644	228,402	19,033	825,280
Shark			825,277		3				163,772
Sheepshead				2,998	400	5,203	152,925	2,246	13,565
Skate						834	12,560	171	60,444
Smelt				51,676	5,148		3,180	440	183,660
Sole	339	7,055		82,384	36,136	10,944	40,988	5,814	2,155,863
				1,933,022	65,780	147,190	9,683	188	

Split-tail			11,759						11,759
Striped Bass			418,270	9,896	40				428,206
Sucker			6,575						6,575
Swordfish, Broadbill							11,464	4,465	15,929
Swordfish, Marlin							343		343
Tomcod				243					243
Totuava							96,217		96,217
Tuna, Albacore							916,470		916,470
Tuna, Bluefin							3,089,512	5,555	3,095,067
Tuna, Bonito							1,904,593	784,388	2,688,981
Tuna, Skipjack							258,909	751,508	1,010,417
Tuna, Yellowfin							7,718,528	11,628,596	19,347,124
Turbot				32,515	416				32,931
Whitebait	11,267	30,440		5,697	16,823				64,227
Whitefish							7,479	6,291	13,770
Yellowtail							190,165	426,608	616,773
Miscellaneous Fish	75	1,531	1,485	73,822	5	58	2,522		79,498
Crustacean:									
Crab	2,621	36,444		1,097,950	59,014				1,196,029
Crab, Rock							8,475		8,475
Lobster, Spiny							10,066	28,131	38,197
Prawn							12		12
Shrimp				587,704					587,704
Mollusk:									
Abalone					740,550	125,950			866,500
Clam, Cockle				21,542			11,884		33,426
Clam, Great Washington		600		440					1,040
Clam, Pismo					441	29,708			30,149
Clam, Soft-shell		210		67,086					67,296
Clam, Washington		4,756		344					5,100
Octopus		124		3,072	6,521		89		9,806
Oyster, Eastern				60,916					60,916
Oyster, Native				25,999					25,999
Squid					429,556		4,465		434,021
Amphibian and Reptile:									
Frog			60						60
Turtle								2,601	2,601
Total pounds	64,270	1,644,959	1,488,893	5,152,127	2,932,216	492,511	28,030,528	18,956,505	58,762,009

*Fresh fish importations from foreign countries included. See importation tables.

FRESH FISH IMPORTATIONS BY POINT OF ORIGIN, APRIL, MAY AND JUNE, 1934

Compiled by the Division of Fish and Game, Bureau of Commercial Fisheries

Species	Gulf of California	West coast Mexico and international waters south of boundary	From Cape Corrientas to Gulf of Fonseca	Costa Rica	Panama	Galapagos Islands	Japan	Total pounds
Barracuda		31,180						31,180
Cabrilla	26,629	191,660						218,289
Corbina, Mexican	16,903	392						17,295
Grouper		40,907						40,907
Halibut, California		72,380						72,380
Mackerel, Pacific		90,866						90,866
Mackerel, Spanish		1,584						1,584
Perch		278						278
Rock Bass		47,925						47,925
Rockfish		51,928						51,928
Sardine		613						613
Sea-bass, Black	460	169,341						169,801
Sea-bass, White		4,045						4,045
Shark		604						604
Sheepshead		171						171
Sole		40						40
Totuava	96,217							96,217
Tuna, Albacore							916,470	916,470
Tuna, Bonito		73,012						73,012
Tuna, Skipjack		868,584		16,088	125,495			1,010,167
Tuna, Yellowfin		14,165,169	281,265	1,424,638	2,566,552	754,058	155,442	19,347,124
Whitefish		5,808						5,808
Yellowtail		506,448						506,448
Miscellaneous Fish		360						360
Crustacean:								
Lobster, Spiny	136	38,061						38,197
Mollusk:								
Clam, Cockle	7,800							7,800
Reptile:								
Turtle		2,601						2,601
Total pounds	148,145	16,363,957	281,265	1,440,726	2,692,047	754,058	1,071,912	22,752,110

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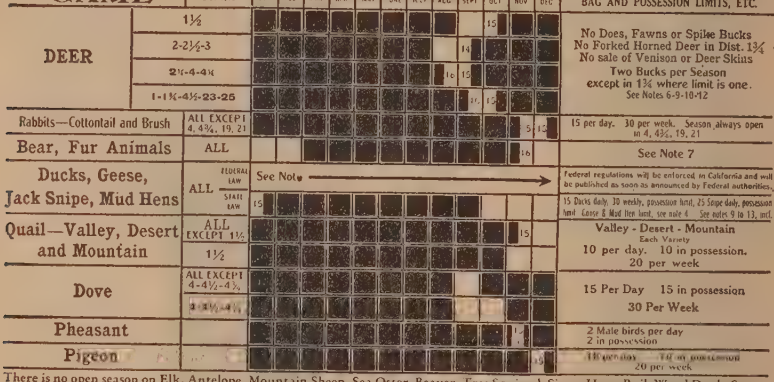
1933–ABSTRACT CALIFORNIA SPORTING FISH & GAME LAWS–1935

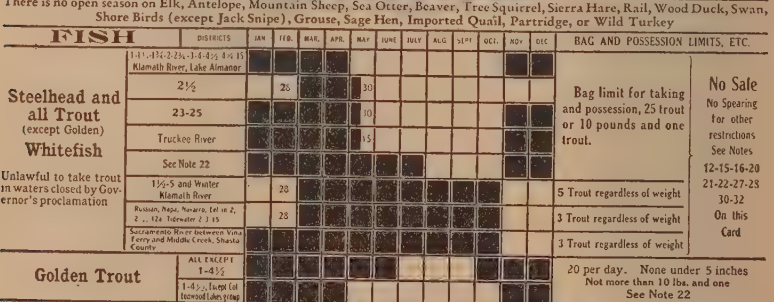
THIS ABSTRACT WILL BE VALID UNTIL 90 DAYS AFTER ADJOURNMENT OF THE 1935 LEGISLATIVE SESSION

OPEN AND CLOSED SEASONS

WHITE SQUARES INDICATE OPEN SEASON. NUMBERS IN SQUARES ARE OPEN DATES



There is no open season on Elk, Antelope, Mountain Sheep, Sea Otter, Beaver, Tree Squirrel, Sierra Hare, Rail, Wood Duck, Swan, Shore Birds (except Jack Snipe), Grouse, Sage Hen, Imported Quail, Partridge, or Wild Turkey



SALMON, See Note A. **STURGEON, No Open Season (possession prohibited).**

NOTES

IT IS ALWAYS UNLAWFUL

1. To hunt, kill, possess wild birds or mammals, to possess firearms, except under written permit from the Commission, in Dists. 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q, 1r, 1s, 1t, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 4a, 4b, 4c, 4d, 4e, 4f, 4g, or General Grant Refuge, or Mt. Tamalpais Game Refuge, including Richardson Bay, or San Francisco Refuge, or Silver Lake Refuge (water fowl may be killed in 4a and 4e), or to hunt quail in Bolinas Quail Refuge, or to hunt or discharge firearms in Huntington Lake Refuge, San Leandro Bay Refuge, or Monterey Peninsula Refuge.

2. To hunt birds or mammals excepting predators without a hunting license. To hunt in areas closed by proclamation.

3. To possess any bird net or to net, trap or to hold protected game or birds of any kind, their nests or eggs except under written permit from the Commission.

4. To take more than 4 geese per day, 8 per week of all varieties, and 12 Canada geese and black sea brant. To take more than 25 mud hens per day, 50 per week. To have more than 1 daily bag limit of geese and mud hens in possession by 1 person in 1 day.

5. To take or kill nongame birds, except blue jay, butcher bird, English sparrow, sharp-shinned, Cooper or duck hawk, great horned owl, linnet, crow, black-billed magpie, white pelican, shag, and in Dists. 1, 2, 3, 4 and 4½, blackbirds.

6. To hunt deer without deer tag license. To fail to attach to horns of deer immediately on killing, properly filled out deer tag or at same time to send duplicate tag to Division. To carry deer into closed district without having deer tag countersigned, or to have untagged deer in possession. To fail to retain in possession during open season and for 10 days after, skin and portion of head bearing horns of deer killed and to produce upon demand. To use more than 1 dog to hunter in hunting deer or to allow dogs to run deer in closed season, or to possess doe or fawn skins, or deer skins not bearing evidence of sex.

7. To trap for profit without first procuring a trapping license bear, ring-tailed cat, coon, pine marten, skunk, fisher, wolverine, mink, river otter, fox or muskrat, or to kill same during closed season, except when destroying property. To interfere with traps of licensed trappers. To use saw tooth or spike-jawed traps for taking fur bearers.

8. To use any animal other than dog to stalk wild birds.

9. To shoot game from power boat, sailboat, auto, airplane, or to hunt waterfowl from scull boat in Dists. 8, 9, except on Wed. and Sun., or at any time in Dist. 12 or Napa River south of Edgerly Island, and in Mare Island Straits from the Napa River to Carquinez Strait, or to use shotgun larger than 10 gauge, or to possess an extension automatic or cane gun. To have in possession any device capable of or to be used in silencing the report of any firearm.

10. To shoot resident game between ½ hour after sunset and ½ hour before sunrise, or migratory game between sunset and ½ hour before sunrise. To use a spotlight in hunting game.

11. To drive game birds by means of auto, airplane, or power boat over shooters.

12. To hold game or fish longer than 5 days after close of season; venison 15 days.

13. To sell wild game, except cottontail and brush rabbits.

14. To make a false statement in applying for license. To fail to show license upon demand to any officer.

15. To take game or fish from one district to another when season is not open in both. (Special law for deer, trout and black bass.) Trout legally taken may be transported from open district into closed district by the consignor making an affidavit in duplicate setting forth his name, address, number of angling license and name and address of consignee. Original must be attached to shipment; copy left on file with officer before whom sworn. Trout may be shipped into closed district when accompanied by written statement to effect that trout were legal, signed by shipper, countersigned by agent to whom offered for shipment. Black bass legally taken may be transported from open district into closed district.

16. To ship wild birds, mammals, or fish except smoked or dried fish other than trout by parcels post, or in concealed packages or without a tag bearing name and address of consignee and consignor and contents, or to ship game out of State.

17. To operate a commercial hunting club without license.

18. To place obstructions in streams in Dists. 1, 1½, 2, 2½, 2¾, 3, 4, 4½, 22 and 25 that will stop or impede fish.

19. To sell striped bass taken with hook and line; to transport or carry striped bass out of State. To ship striped bass less than 20 in. in length or more than 10 lbs. in weight. To possess more than 5 shad per day between June 1 and Feb. 14.

20. To take trout other than with rod and line held in hand or with lure with more than 2 attached hooks or more than 3 hooks. To take trout except by angling in such manner as to cause trout to voluntarily take hook in its mouth.

21. To have in possession any fish spear or gaff (except landing gaff) within 300 feet of any lake or stream when unlawful to spear salmon.

22. To take trout in any lake within 200 feet of mouth of any stream from Oct. 31 to Aug. 1, or in that portion of any stream flowing into any lake in Dist. 23 within 2 miles from its mouth, upstream, from Oct. 31 to Aug. 1. To take golden trout in Cottonwood Lakes group, including South Fork Cottonwood Lakes group and ½ mile of stream below the lower lake in each of said groups, except from July 1 to Oct. 31.

23. To bring to shore crabs or lobsters in such condition that size can not be taken; or to ship or carry crabs out of Dists. 13, 2½, 5, 6, 7, 8 or 9. To sell any crabs taken in Eel River or tributaries or to possess more than 10 crabs taken there or to take any between ½ hour after sunset and ½ hour before sunrise.

24. To take or possess in Dist. 3 salt water eels of less than 12 in. or more than 15 per day.

25. To take or possess cockles less than 1½ in. in diameter, or to take or possess more than 15 (Dists. 2 and 10) Washington clams or more than 10 horse clams or more than 30 razor or jackknife clams per day, or in Dists. 18, 19, 21 more than 15 lbs. of mussels per day. To take or possess any Pismo clams in Dist. 18 between ½ hour after sunset and ½ hour before sunrise, or to possess any clam digging implement in that district. To possess any clam digging implement in any clam preserve.

26. To take red abalones less than 7 in. in greatest diameter; green, 6½; pink, 6; black, 5; to dry abalones; to dive for abalones in Dists. 7, 15, 16, 17, 19, 20 and 20a; to take more than 10 per day or 20 per week in Dists. 7, 15, 16, 17, 19, 20 and 20a. To take more than 10 per day from shore in Dists. 7, 10 and 18; to take more than 10 black abalones per day in Dists. 15, 16, 17, 18, 19, 20, 20a, 21. To possess more than 10 per day in Dist. 2.

27. To fish for game fish without having an angling license.

28. To take game fish between 1 hour after sunset and 1 hour before sunrise in Dists. 1, 1½, 1⅞, 2, 2½, 2⅝, 3, 4, 4½, 4⅝, 23, 25. To take striped bass by hook and line between sunset and sunrise.

29. To fish with nets except in commercial districts or to injure any legal net.

30. To fish through ice for any fish or to take fish in Dist. 14.

31. To place, cause to be placed, or discharge into any waters substances deleterious to fish or plant life.

32. To fish within 250 ft. of fishway or 150 ft. of upper side of fish screen, or lower side of dam, or to take fish except salmon within ½ mile of either side of spawning station, or any lake within ½ mile of spawning station when station is in operation.

33. To kill, injure or capture Cal. sea lions in Dists. 19, 20, 20a.

34. To take invertebrates or marine plants in Hopkins Marine Refuge (Monterey Co.) or in that area between the west line of the property of the Scripps Institute and a line 1,000 feet west of low tide line (San Diego Co.).

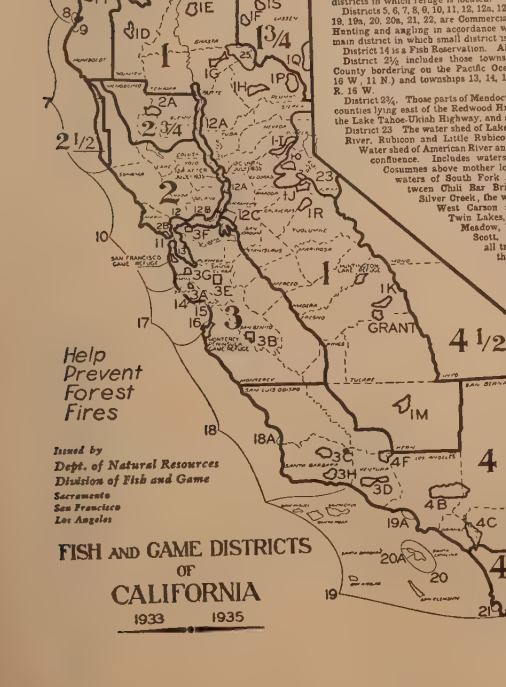
35. To take more than 5 white sea bass from May 1 to June 30, or to take at any one time more than 5 under 28 in.

36. To take more than 30 lbs. of halibut under 4 lbs. each, or to take more than 5 barracuda less than 3 lbs. each.

37. To take frogs less than 4 in. in length measured from tip of nose to posterior end of body between hind legs, or to take or possess more than 24 frogs per day or 48 frogs per week.

NOTE A.—SALMON. Salmon can not be taken on spawning beds, or within 10 miles of spawn-taking station, or 3 miles north and south of mouth of Klamath River. All salmon boats must have landing net, and no Chinook less than 27, or silver less than 24 in. can be taken in ocean and Humboldt Bay Dists. Undersized salmon can not be gaffed or clubbed, or brought ashore in such condition that size can not be determined. Salmon may be taken with hook and line in any district when trout season for said district is open.

In Dist. 1, salmon may be taken with hook and line or spear between May 29 and Oct. 31, except (a) in Feather River from its mouth to mouth of the Yuba; (b) in American River from its mouth to Fair Oaks bridge. In Dist. 2, (c) in Russian, Napa and Navarro rivers; (d) in Eel River and (e) in tidewater in Dists. 2, 3 and 4. With hook and line from May 1 to last day of Feb., bag limit 2 per day, and 15, with hook and line from May 1 to last day of Feb., bag limit 2 per day. In Feather River between mouth of Yuba and Thermalito bridge, with hook and line between May 29 to Dec. 31; with spear from Aug. 1 to Dec. 31. In Dist. 2, bag limit 2 per day. In Dists. 2, 2½, with hook and line from May 1 to Feb. last; with spear from Nov. 1 to Feb. last, bag limit 2 per day. In Dist. 3, with hook and line from May 1 to Oct. 31, bag limit 2 per day. In Klamath River Dist. above tidewater, with hook and line from May 29 to Dec. 31; with spear, from Aug. 1 to Oct. 31, bag limit 2 per day. In Klamath River Dist. in tidewater, with hook and line from May 29 to Dec. 31. Bag limit 1 daily bag limit in possession. In Dists. 6, 7, 8, 9 with hook and line from April 1 to Sept. 15, no bag limit. In Dist. 7, with hook and line from May 1 to Aug. 30, no bag limit. In Dists. 12, 12B, 12C, 13, with hook and line at any time, no bag limit. In Dist. 12A, with hook and line from May 1 to Feb. last, bag limit 2 per day. In Dists 15, 16, 17, 18, with hook and line from Mar. 1 to July 15.



LICENSES MUST BE SHOWN UPON DEMAND

Districts 1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1m, 1n, 1o, 1p, 1q, 1r, 1s, 1t, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 3f, 3g, 3h, 4a, 4b, 4c, 4d, 4e, 4f, 4g, are Game Refuges. Hunting prohibited. Angling in accordance with law relating to main districts in which refuges located.

Districts 5, 6, 7, 8, 9, 10, 11, 12, 12a, 12b, 12c, 13, 16, 17, 18, 19, 19a, 20, 20a, 21, 22, are Commercial Fishing Districts. Hunting and angling in accordance with law relating to main district in which small district is located.

District 14 is a Fish Reservation. All fishing prohibited.

District 2½ includes those townships in Mendocino County bordering on the Pacific Ocean (except 15 and 16 W., 11 N.) and townships 13, 14, 15, 16, 17 and 18 N., R. 16 W.

District 2¾. Those parts of Mendocino, Lake and Colusa counties lying east of the Redwood Highway and north of the Lake Tahoe-Ukiah Highway, and all of Glenn County.

District 23. The water shed of Lake Tahoe and Truckee River, Rubicon and Little Rubicon above confluence.

Water shed of American River and Silver Creek above confluence. Includes waters in water shed of Cosumnes above mother lode highway bridge, waters of South Fork American River between Chili Bar Bridge and mouth of Silver Creek, the waters of the Carson, West Carson and all tributaries, Twin Lakes, Silver, Twin, Blue, Meadow, Wood, Winnemucca, Scott, Burnside Lake and all tributary streams and the drainage area of Webber Creek above mother lode highway bridge.

Sporting fishing licenses are required for the taking of the following: fish and mollusks only: tuna, yellow tail, marlin, broad bill swordfish, yellow fish or black sea bass, albacore, barracuda, bonita, rock bass, California whiting (also known as croakers and surf fish), yellow bass, crooker, spotfin croaker, salmon, steelhead and other trout, chars, whitefish, striped bass, black bass, perch, crappie, calico bass, Pismo clams, abalones, and all varieties of mollusks.

LICENSE PROVISIONS

HUNTING

License year July 1 to June 30

Residents under 18	$1.00
Resident citizens	2.00
Nonresident citizens	10.00
Declarant aliens	10.00
Other aliens	25.00

ANGLING

License year January 1 to December 31

Resident citizens	$2.00
Nonresident citizens	3.00
Aliens	5.00
Under 18 no license required	

TRAPPING

License year July 1 to June 30

Citizens	$1.00
Aliens	2.00
Under 18 no license required	

DEER TAG

License year January 1 to December 31

Everyone (2 tags)	$1.00

COMMERCIAL HUNTING CLUBS

License year July 1 to June 30

Citizens	$25.00
Aliens	100.00
Operators, citizens	5.00
Operators, aliens	25.00

For Laws in Full See Fish and Game Code

For Commercial Fish Laws See Commercial Abstract

For Information Regarding Fish or Game Write to the Division of Fish and Game

BUREAU OF PATROL

E. L. MACAULAY, Chief of Patrol—San Francisco
K. P. Allred, Assistant Chief of Patrol—San Francisco
C. S. Bauder, Assistant Chief of Patrol—Los Angeles

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